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Skeptical Inquirer

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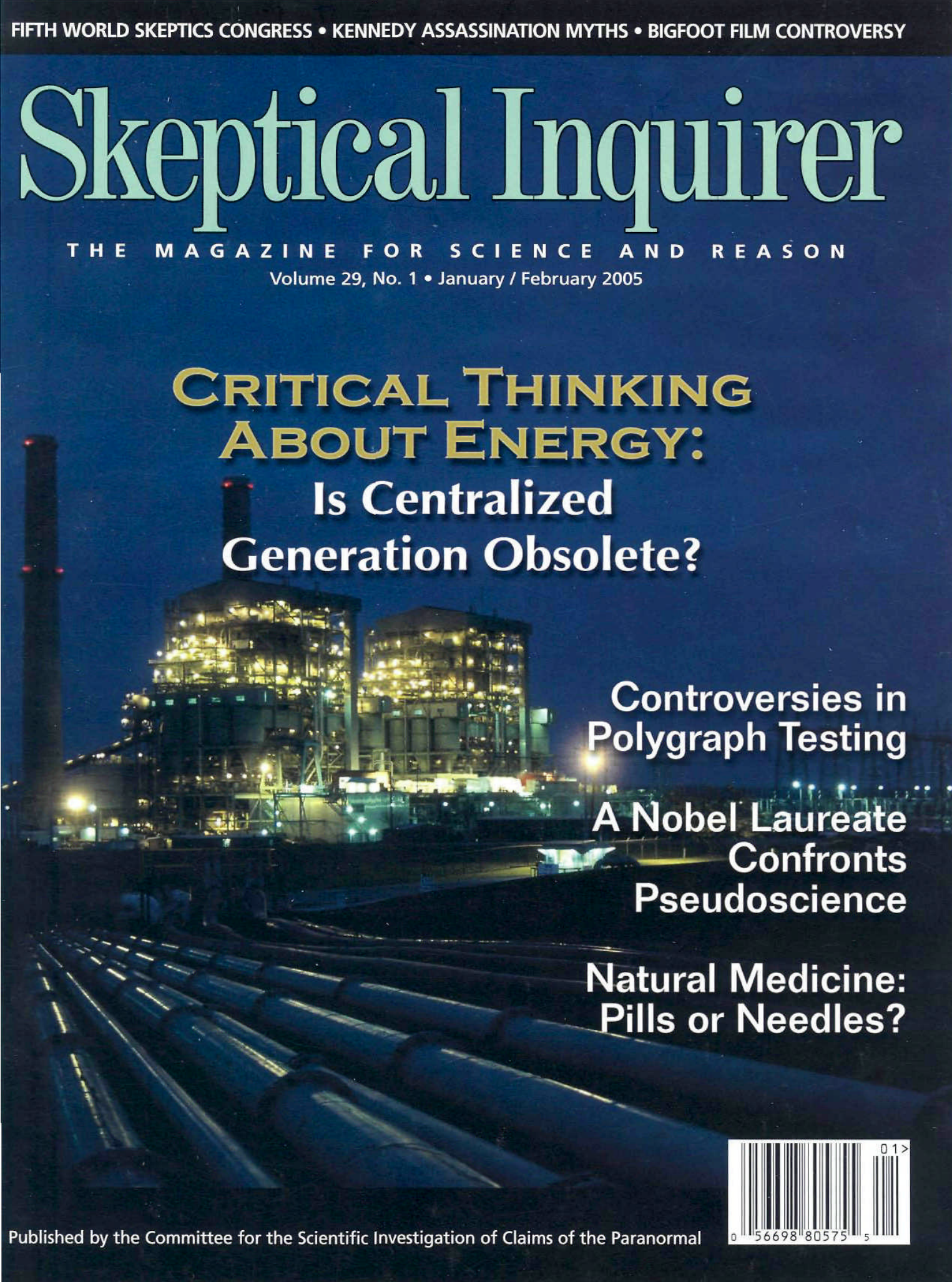

CRITICAL THINKING ABOUT ENERGY: Is Centralized Generation Obsolete?

Controversies in Polygraph Testing

A Nobel Laureate Confronts Pseudoscience

Natural Medicine: Pills or Needles?

Published by the Committee for the Scientific Investigation of Claims of the Paranormal

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EDITOR'S NOTE

Critical Inquiry, and Thinking About Galileo

In an editorial in our January/February 2004 issue, I spoke of our intention in the SKEPTICAL INQUIRER "to examine more issues of broad social import that involve science and technology, not duplicating the efforts of other publications but wherever we see an opportunity for science, reason, and critical inquiry to play a useful role."

The first two articles in this issue are in that vein. The first, on the merits of decentralized vs. centralized generation of electrical energy, is indeed a totally new topic for us. The second, a balanced and informed look at polygraph testing, is one we have dealt with regularly, with at least five earlier articles and news pieces from 1990–2003.

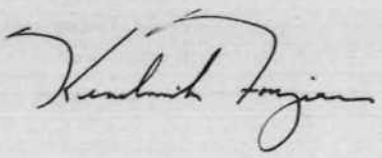
And that fact makes another point: We have never limited ourselves to investigations of paranormal or pseudoscientific claims. In the early 1990s I made a list of past SI articles that fell into neither of these categories. It covered an entire page. A similar list today would be much longer. But what all have in common is applying critical inquiry to science-related claims and issues of popular appeal or public importance.

Tom Casten, lead author of our cover article, is an energy entrepreneur who brings a background in economics and deep interests in science, technology, and critical thinking (he has long been associated with CSICOP) to his examination of the relative efficiencies of centralized vs. decentralized generation of power. I think you will find the revelations by him and colleague Brennan Downes surprising.

Many first-rate scientists are often by necessity so narrowly focused on their work that they have little time or inclination to get involved in wider issues. Others somehow manage to commit themselves to science education, writing for the public, bringing scientific insights to public policy debates, and defending science against promulgators of pseudoscience. Physicist and 2003 Nobel Prize recipient Vitaly L. Ginzburg is clearly one of the latter. We present two articles by him in this issue, both confronting specifics of pseudoscience and showing how it differs from real science.

* * *

The evening-long tribute to Galileo at the Fifth World Skeptics Congress near Padua, Italy (see the ensuing pages), was a moving experience. Knowledgeably hosted by television journalist and science author Piero Angelo, part of it featured actors playing Galileo and the three figures in his two key "Dialogues." Padua and Florence were the cradle of the Italian renaissance, with creative new thinking and discoveries in art, architecture, medicine, and science. It was equally moving later (in Venice), to see wooden models of Leonardo's inventions, climb up to Brunelleschi's dome in Florence, and visit the science history museum in Florence where many of Galileo's scientific instruments are displayed. Returning home, I reread J. Bronowski's memorable chapter in *The Ascent of Man* on Galileo's trial. A concluding passage notes one effect of this terrible wielding of ideology and power against science and open inquiry: "The effect of the trial and of the imprisonment was to put a total stop to the scientific tradition in the Mediterranean. From now on the Scientific Revolution moved to Northern Europe." Can such a shift still happen today, when many powerful ideological interests are so distrustful of at least certain aspects of science? It's a sobering thought.



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In the Land of Galileo, Fifth World Skeptics Congress Solves Mysteries, Champions Scientific Outlook

KENDRICK FRAZIER

The legacy of Galileo shone like a brilliant star throughout the Fifth World Skeptics Congress, Oct. 8–10, 2004, and appropriately so, for it was held in Abano Terme, Italy, just outside of Padua (Padova), where Galileo taught from 1592 until 1610, wrote *The Starry Messenger*, and discovered the moons of Jupiter.

Other revolutionary figures in the history of science likewise had Padua connections. Among them were Nicolaus Copernicus, who studied there, and Andreas Vesalius, who took his medical degree there before publishing his revelations about human anatomy in 1543. That was the same year that Copernicus published, on his deathbed, *On the Revolution of the Heavenly Spheres*, the book that cast aside the notion of an Earth-centered universe. Thus began the conflict between religious belief and scientific discovery that led to Galileo's epic tribulations with the Catholic church and that echoes down through the ages to this day.

The conference theme was "Solving Mysteries." Throughout, speakers touted the unique abilities of the methods of scientific and skeptical inquiry in finding solutions to mysteries that otherwise remain the domain of opinion and speculation.

The three-day conference, which had a sold-out attendance of nearly 500 (the capacity of the comfortable modern conference center's theater, surrounded by hotels and restaurants), was cosponsored by the Committee for the Scientific Investigation of Claims of the Paranormal (CSICOP) and its Italian counterpart group, CICAP (pronounced "chee-cap"). CICAP numbers among its members some of Italy's leading scientists, scholars, and investigators, many of whom were in evidence as conference participants.

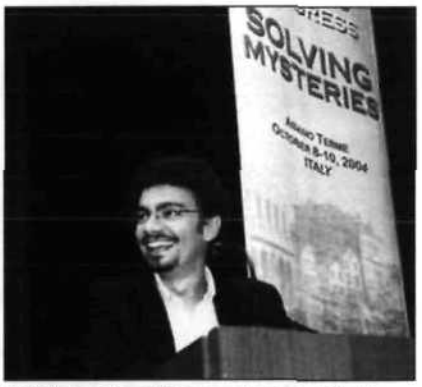
Galileo himself was the subject of an entire evening of special events the first night of the conference, while a slightly more recent hero of skepticism, the conjuror and investigator James Randi, was feted the second night (see side stories). Randi also gave a talk earlier that day on "difficult, innocent, and impossible applicants" for his $1 million challenge to psychic claimants.

CICAP Chairman Steno Ferluga, professor of astrophysics at the University of Trieste, opened the conference with a basic statement of the meeting. CICAP, CSICOP, and the skeptical movement represent a "new thing," he said. "Finally there exists a network of people to find answers, offer corrections, and provide accurate information on popular mysteries."

This "light of reason" can help confine paranormal beliefs to those who want to believe, instead of to all those previously innocently confused by misinformation about claims once ignored by scientists. "We skeptics don't deny mysterious events," he said. "We come here to solve them."

In his opening remarks, CSICOP Chairman Paul Kurtz, professor emeritus of philosophy at SUNY–Buffalo, noted that he had come to Italy three times beginning twenty years ago to encourage Italian scientists and skeptics to organize a group. He said he was pleased with the subsequent work of that group, which has high visibility in Italy, and the grand conference it had organized. The modern skeptical movement has provided "a critical scientific examination" of popular claims and "a *whole new literature*," Kurtz said. But he gave equal emphasis to a "second principle" of the movement: "to explicate and defend science and reason and the scientific outlook. . . . We are interested in cultivating public appreciation of science."

"This is positive," he said "—carrying to the general public our appreciation of this powerful invention, the discovery of



CICAP's Massimo Polidoro moderates a World Skeptics Congress session.

Key World Skeptics Congress figures, from left, Massimo Polidoro, co-chairman Paul Kurtz, Piero Angela, James Randi, and co-chairman Steno Ferluga.

"Investigating Historical Mysteries" session panelists, from left, Joe Nickell, Mariano Tomatis, Luigi Garlaschelli, and James Randi.

truth about nature through experimental science."

So in this mission, Kurtz said, "the skeptical movement has moved on . . . to other equally important things."

Kurtz spoke admiringly of Galileo. "In one sense," he said, "Galileo is a symbol of skeptical inquiry. He questioned authority. He rejected authority—Aristotle, the Church.

"Galileo is the great martyr to the skeptical cause," Kurtz said. He rejected occult explanations, and he championed a new method involving experimentation, hypotheses, theories, and mathematics.

"Galileo was a heroic figure, a great skeptic," said Kurtz. "He was not a dogmatic skeptic, but thought that there were reliable methods for achieving knowledge."

And one more point from Kurtz: "Science and skepticism go hand in hand. Skepticism is a great tool of science."

Thus began three sparkling days of presentations, discussions, questions, entertainment (including a lunchtime first-ever performance of "skeptical" arias from famous operas), and special events and demonstrations.

It was a truly international conference, with attendees from twenty countries. Speakers heralded from Argentina, Belgium, Canada, China, Egypt, Germany, Italy, France, Russia, Spain, the United Kingdom, and the United States. The conference language was English, with simultaneous translation into Italian, although occasionally that was reversed.

Formal conference sessions dealt with parapsychology (moderated by Ray Hyman, University of Oregon); hoaxes, fakes, and myths (Lorenzo Montali, University of Milan); investigating historical myths (Massimo Polidoro, University of Milan—his column in this issue on fact and fiction about the Kennedy assassination is based on his presentation); magic and the psychology of deception (Sergio Della Sala, University of Edinburgh); the future of skepticism and a world skeptics update (Barry Karr, CSICOP); and how alternative medicine can be hazardous to your health (Silvio Garattini, Mario Negri Institute, Milan). Three or four leading figures in these fields spoke in each session, followed by a lively question period.

Only a few highlights can be mentioned here, some brief examples. CICAP plans to eventually publish a book based on the conference proceedings.

The opening session, "Parapsychology and Skeptics: Is Dialogue Possible?" had a bittersweet quality because the scheduled leadoff speaker, Robert L. Morris, professor of parapsychology at the University of Edinburgh and highly respected by both skeptics and parapsychologists, had died unexpectedly in August. He was only sixty.

Carolyn Watt, a senior research fellow at Edinburgh's Koestler Parapsychology Unit, which Morris had established and headed, gave a talk in his stead, dedicated to him. She spoke on "productive and unproductive interactions" between parapsychologists and skeptics, urging more of the former and less of the latter. In the productive category are "direct, personal, involvement and collaborations," much like Hyman has done in the past with Charles Honorton or that Richard Wiseman has carried out in the U.K. Unproductive interactions include debates at a distance, which become increasingly polemical, and unsupported and sweeping statements, including unscientific rhetoric and misrepresenting opponents' views.

Richard Wiseman (University of Hertfordshire), who has high visibility in the U.K. as a psychologist who involves parapsychologists, the media, and the public in his investigations, spoke of some of his recent experiments, including research with a medium described recently in *The Times* (U.K.) and his "Mind Machine," a multimedia interactive kiosk that invites the public to participate in an extrasensory perception experiment. In 139,000 trials with 28,856 people, he said, the hits amounted to 49.90 percent —"chance," he reported. "No evidence of ESP." He said this is an example of how skeptics can do research that involves the public.

As for Carolyn Watts's call for more interactions between skeptics and parapsychologists, Wiseman agreed, to a point. "Should we collaborate if the research is about genuine open inquiry? Yes," he said. Skeptical psychologists can and have helped mightily with a number of parapsychology experiments, he said, tightening up controls and finding small errors, which can easily creep in. But too many parapsychological researchers have another aim altogether, he said. "There are people who are certain of the answers," he said. "They are engaged in a process of persuasion, not inquiry, and they have an agenda. CSICOP looks at these people very carefully. Should we collaborate with them? No."

James Alcock (York University, Toronto) described why parapsychology, despite its long history of research, some of it involving eminent scientists, still has gained no status as a science and is in fact ignored by most scientists. There is no unambiguous definition of a psi phenomenon, no strongly replicated effect, no theory offered, no consistency with other areas of science, and no progressive accumulation of knowledge. "Despite a long history, parapsychology does not have a single acknowledged 'fact,'" said Alcock.

Furthermore, he said that collaboration with parapsychologists is difficult. "Parapsychologists can't propose what would *dis*confirm psi," he lamented. "To them, finding nothing doesn't count. . . . We can help by being respectful and constructive and by being hard-nosed and critical. But the problem is that the failure to find supporting evidence will not dampen parapsychological zeal."

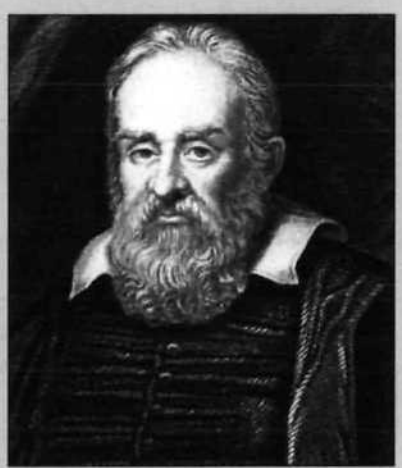
The session on investigating historical mysteries featured several interesting case studies. CSICOP's senior research fellow and SI "Investigative Files" columnist Joe Nickell reported on his investigations into such cases as the Flatwood Monster, the Nazca lines, and the Shroud of Turin. Researcher Mariano Tomatis (Turin, Italy) described his investigations into the "Da Vinci code" story, and Luigi

Garlaschelli (University of Pavia) described his literally hands-on investigations into the "real sword in the stone" (in Italy). Randi's previously mentioned talk followed. We hope to have articles based on several of these presentations in future issues.

In the "Hoaxes, Fakes, and Myths" session, archaeologist Kenneth Feder (Central Connecticut State University) gave a revealing report on media dynamics intriguingly and accurately titled "Atlantis in Fantasyland: Making a Mickey Mouse Television Documentary About the Lost Continent." He told of his experiences a few years ago with a producer of an ABC television documentary about Atlantis. The producer told Feder he was looking for an archaeologist who was pro-Atlantis. Feder told him there were none, because Atlantis didn't exist. When Feder asked why they made that request, the producer pointed out that the ABC network was owned by the Disney company, which was about to launch its animated film about Atlantis and implied that they expected ABC to make a documentary that would leave open the possibility that Atlantis was real. (For critiques of both the ABC show and the Atlantis myth, see *SI*, January/February 2002.)

One of the highlights for many members of the audience was moving talks by two speakers from Egypt, Mourad Whaba (professor emeritus of philosophy at the University of Ain Shams in Cairo and president of the Afro-Asian Philosophy Association) and Mona Abousenna, a professor at the same university. Abousenna described the extraordinary challenges and perils

The World of Galileo Galilei



As befitted a conference outside Padua, the first evening featured a nearly three-hour special event, "The World of Galileo Galilei." It was hosted by Piero Angela, a noted Rome-based television journalist in Italy, author of books on science and skepticism, and one of the key people responsible for the founding of CICAP. Paul Kurtz calls him "the Walter Cronkite of Italy," and Angela's knowledgeable on-stage interviews and hosted demonstrations with leading Galileo scholars and even an actor playing Galileo showed why.

Angela first interviewed Maria Mariapiera Marenzana, a professor of literature in Rome and a biographer of Galileo, about Galileo's life and work. Oxford University Press will publish her book in English in 2005.

Not only was Galileo a great man of science with notable discoveries on the principle of inertia, the fall of free bodies, and the pendulum as well as the works for which he was even better known, "He was a Renaissance man *par excellence*," she said. He had enormous curiosity, she said, "He was a great writer, and he could sing, paint, and write poetry."

She was soon joined on the stage by her husband, Andrea Frova, professor of physics at the University of Rome who holds the same chair once held by Enrico Fermi. He spoke in more detail about Galileo's work, referring to the astonishing variety of his inquiries. He even noted that Galileo occasionally was wrong. "Galileo studied so many things he couldn't always be right. He believed planetary orbits were circles, and he made a wrong guess about the tides. He thought they were due to Earth's rotation. This shows that everyone can make mistakes."

Angela next introduced Alessandro Bettini, professor of physics at the University of Padua, who had brought a large wooden inclined plane plus measuring instruments like those Galileo had used in his experiments demonstrating that objects fell at the same velocity regardless of their weight. Bettini demonstrated their use and said, "The scientific method was *the major contribution of Galileo.*"

These discussions were interspersed with clips from a little-known Italian motion picture about Galileo's life and his conflict with church authorities, a movie Angela said was not well known even in Italy. It ended with the trial of Galileo. The Holy Office found him "vehemently suspected of heresy" for "having held and believed the doctrine which is false and contrary to the Sacred and Divine scriptures, that the Sun is the center of the world and does not move from east to west and that the Earth moves and is not the center of the world." Galileo is shown the Inquisition's instruments of torture and then seen reading his hand-written confession and recantation "abjuring" any such beliefs. "I curse and detest the said errors and heresies" and will "never again say nor assert in speaking or writing such things," he was required to state.

It was an emotional end to the evening. CSICOP's Paul Kurtz was visibly moved. He told me CICAP should be praised for presenting the Galileo tribute because the Galileo affair is still a sensitive issue in Italy. And he again mentioned Galileo's great courage. "The trial of Galileo was a terrible thing. It ruined him."

—*K.F.*

Piero Angela interviews Galileo biographer Maria Mariapiera Marenzana.

of even speaking about skeptical inquiry and rationalism in an Islamic country like Egypt. Many seemed moved by her courage and determination. In answer to a question, Professor Whaba said, "My students like me, but they don't like my ideas." At the same session was Prof. Edward Kruglyakov of the Russian Academy of Sciences, who reported on efforts by Russian scientists to criticize anti-science, and Li Sheng Xian, a representative of a five-member Chinese delegation.

The conference concluded with a lively session of critical examinations of evidence about alternative medicine. A few excerpts:

Edzard Ernst (Professor of Complementary and Alternative Medicine, Universities of Exeter and Plymouth, U.K.) On herbal remedies: "We have convincing positive data for nine herbal remedies (especially St. John's Wort, for mild to moderate depression), but not *thousands* [as frequently claimed]."

On acupuncture: "There is limited evidence that acupuncture is better than no treatment at all. There is inconclusive evidence that acupuncture is better than a placebo."

On spiritual healing: "The majority of rigorous trials show no effect beyond placebo."

Ernst's conclusion: "High quality research is scarce. Bias is rife. For some CAM [Complementary and Alternative Medicine] treatments the risk/benefit ratio is positive. But for most, we don't know."

Barry Beyerstein (Simon Fraser University, Vancouver, British Columbia): "The curriculum of the Dominion Herbal College in Vancouver—the leading college of herbalism in North America—exhibits every characteristic of pseudoscience in [CSICOP Fellow and McGill University philosophy professor] Mario Bunge's list" (Bunge, "What Is Pseudoscience?" SKEPTICAL INQUIRER, Fall 1984).

Riccardo Lucio (University of Florence): "Homeopathy *is* useful. . . . It is useful to the industry, to the sellers, and to the homeopaths. But it is highly questionable if it is of use to patients."

Wallace Sampson (professor of medicine, Stanford, and editor of the *Scientific Review of Alternative Medicine*) gave a blunt assessment of what he calls "the political takeover in the U.S." by alternative medicine.

"Never in the history of medicine has there been anything like this before," he said. "It is an organized invasion of pseudoscience into the scientific edifice of medicine. It is pervasive, surreptitious, and purposeful. It is not a conspiracy; it is simply the way people act in groups."

How do they do it? By using the "language of distortion" (*alternative medicine* instead of *quackery* or *pseudoscience*) and by demeaning science (postmodernism and relativism), he said. Proponents' invention of language is calculated to produce a positive response. He said they have become astute in what he called "info-ganda," the combination of information and propaganda. They have been effective in manipulating opinion in nonprofit foundations, the news media, books, and even the medical press, which "has a bias against publishing negative articles." They have found abundant sources of funding both from government (especially in the U.S., through the support of key congressional leaders) and from spiritual/religious organizations. He sees the problem getting worse, not better.

Silvio Garattini, professor of pharmacology and director of the Mario Negri Institute in Milan, summed up the session. "I wonder if by using gentler terms like *alternative medicine* and *complementary medicine*, we are disserving science," he said. "'Quackery'

Randi: That's Amazing

The special event the second night was "Randi: That's Amazing," billed as "A 'Magical' Evening with James Randi."

Massimo Polidoro and James Randi ham it up after the evening special tribute to Randi.

For those who've seen Randi's lectures many times, this was different. It was very interesting because its essence was an extended conversation between Randi and CICAP's Massimo Polidoro (investigator, author, and SI's "Notes on a Strange World" columnist who once studied with Randi). Both were seated comfortably on the stage; Polidoro would ask questions about Randi's life and career, and Randi, now seventy-six but still going strong, answered.

The questions were cued to some "amazing" old film clips shown of Randi in action, some going back to when he was only a teenager doing conjuring tricks in Toronto, and others long before he became the white-bearded scourge of psychics he is today. Many showed his career as an escape artist, including film of him escaping from a straitjacket while being suspended upside down over Niagara Falls in winter and another of him encased in a huge block of ice with those outside frantically trying to chip him out.

Ray Hyman, Richard Wiseman, and Joe Nickell came on stage and performed demonstrations and conjuring tricks.

This, of course, then led in to discussion of Randi's later, still-active career as a debunker of magicians who pretend to be psychic such as Uri Geller. Randi even revealed to the audience exactly how he did two Geller-type tricks when forced into doing so on live radio and television shows with little or no time to prepare.

It truly was a "magical" evening.—*K.F.*

and 'fakery'" is what we are talking about. "We must use what has proved to be effective."

And he spoke of the frustrating illogic of homeopathy. Its remedies are "all the same and contain nothing. How can you test that?" The burden of proof is on the homeopathic community to provide proof that its remedies are efficacious, he said. "But they are not willing."

In his concluding remarks, Paul Kurtz called the conference "inspiring." He lamented the escape from reason in the health fields, among others. "Not believing in things without evidence is still a radical thesis," he said. "We are still attempting to hold the torch of scientific reason and inquiry." He said there are still many "committed to the Enlightenment" but the "danger that we will move away from the scientific outlook is very real. . . . We have a set of ideals. These ideals are very important, and we need to keep the torch of reason lit."

Kendrick Frazier is Editor of the SKEPTICAL INQUIRER. *His book* People of Chaco: A Canyon and Its Culture, *on the archaeology of Chaco Canyon, New Mexico, will be published in an updated and expanded edition by W.W. Norton, New York, in February 2005.*

Alien-Abduction Guru Mack Killed in Accident

John E. Mack—whose position as a Harvard psychiatrist seemed to add legitimacy to his endorsement of alien abduction claims—was killed accidentally in London on September 27, 2004.

He had been attending the T.E. Lawrence Society Symposium in Oxford. On returning to the London home where he was staying, he stepped into a crosswalk and was hit by a car driven by an allegedly intoxicated driver. He was apparently killed instantly.

Mack (b. Oct. 4, 1929) received his medical degree, *cum laude*, from Harvard in 1955. His biography of T.E. Lawrence ("Lawrence of Arabia"), *A Prince of Our Disorder*, won him a Pulitzer Prize in 1977.

In 1994 Mack shocked colleagues and others with his book *Abductions: Human Encounters with Aliens*. He had come to believe that many of his patients had indeed had extraterrestrial encounters which they "remembered" under hypnosis.

Mack was invited to speak at a CSICOP conference in Seattle, Washington, in 1994. Psychologist Robert A. Baker began the session on alien abductions by observing that virtually all such claims represented a psychological phenomenon attributable to the discredited procedure of hypnotic regression. "Once you turn on the imagination," he said, "all things are possible."

Baker also observed that "waking dreams" (which occur in the twilight between being fully awake and fully sleep) can yield apparitions of extraterrestrials as well as produce sensations of floating, falling, or being rendered immobile—effects often associated with alleged alien abductions.

Mack, however, dismissed such attempts to find conventional psychological explanations for abduction experiences, insisting that the cases had "a quality of their own." In addition to defending his position, he asserted that "There is a world of other dimensions, of other realities that can cross over into our own world." He asked his skeptical audience, "Are we seeking to be the arbiters of reality?" In response, CSICOP Chairman Paul Kurtz, who moderated the session, briefly noted that skeptics were merely applying the scientific method to paranormal claims.

Mack's book led the Harvard Medical School to consider censuring him, but after a fourteen-month investigation the school declined on the grounds of "academic freedom." After Mack's death, the attorney who represented him during the investigation, Roderick MacLeish, stated: "He was so caring to his patients, and I hope that is what he is remembered for, and not for being the guy who believed in people's stories of alien abductions."

—Joe Nickell

Joe Nickell is CSICOP's Senior Research Fellow.

Betty Hill, First 'Alien Abductee,' Dies

Eunice "Betty" Hill—whose claimed 1961 encounter with extraterrestrials spawned the alien-abduction mania—died October 19, 2004, at the age of eighty-five. She succumbed to lung cancer at her Portsmouth, New Hampshire, home (just twenty days after the accidental death of abduction guru Dr. John E. Mack).

Betty Hill at a convention of the Mutual UFO Network in 2002 in Rochester, N.Y. (Photo by Joe Nickell)

In 1961, UFO and space-travel buff Betty Hill and her husband Barney (d. 1969) were driving in the White Mountains when they encountered a UFO piloted by alien beings. They reported two hours of missing time as well, and—after suffering stress—underwent hypnosis some two and a half years later. During the sessions they "remembered" being examined by small, grey, large-headed humanoids. Their purported abduction was the subject of a 1966 book and a 1975

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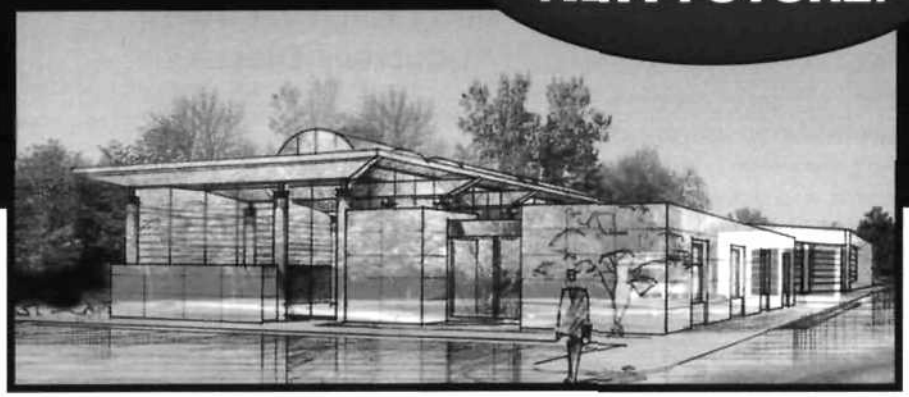

The Center for Inquiry – *Transnational* announces a major 13,600 square foot expansion at its Amherst, New York, headquarters. Slated for completion during 2005, the $2.54 million expansion will more than double conference and seminar capacity, add ten urgently-needed new offices, and enlarge the Center's world-class libraries. This capital project will relieve serious overcrowding and capacity problems, supporting projected program growth of the Center and its affiliate organizations, including the Committee for the Scientific Investigation of Claims of the Paranormal, for years to come.

We are bursting at the seams, and cannot continue program growth without expanding our headquarters. The shelf space of our skeptical and freethought library—the finest in the world—is full. Yet donated books, magazines, and archival materials keep coming. There's an office or workstation everywhere we can put one, yet program and staffing needs continue to grow. Our existing conference and seminar space, opened in 1995, is often overwhelmed by larger and more complex events.

The headquarters expansion is one focus of our $26.26 million New Future Fund capital campaign. Your gift to the New Future Fund today will help to make our desperately-needed headquarters expansion a reality. We seek gifts of cash, publicly-traded securities, paid-up insurance policies, and other assets. Attractive incentive and naming opportunities are offered in acknowledgment of larger gifts. All gifts are fully tax-deductible as provided by law. Please join us and declare your support. Write, call, email, or send the bound-in postcard today!

The new addition will be erected just east of the present building, constructed in 1995.

Three large seminar rooms open off of the new building's central corridor.

Located between the current and new buildings, this Garden Patio will be an exciting focus for seminar meal breaks, media interviews, and other outdoor activities.

Center for Inquiry–*West*, Los Angeles

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made-for-TV movie (starring James Earl Jones and Estelle Parsons). The case served as a model for thousands of subsequent abduction reports over the following decades.

The Hills's psychiatrist, Benjamin Simon, concluded they had experienced a "shared dream" and, indeed specific inconsistencies in Betty's story are characteristic of dreaming. Since she recalled numerous particular details, while her husband recalled very little, Dr. Simon said that the "abduction" was not a shared *experience*; rather it indicated Barney had obtained his knowledge of the incident after he repeatedly heard his wife tell her nightmares to neighbors and friends.

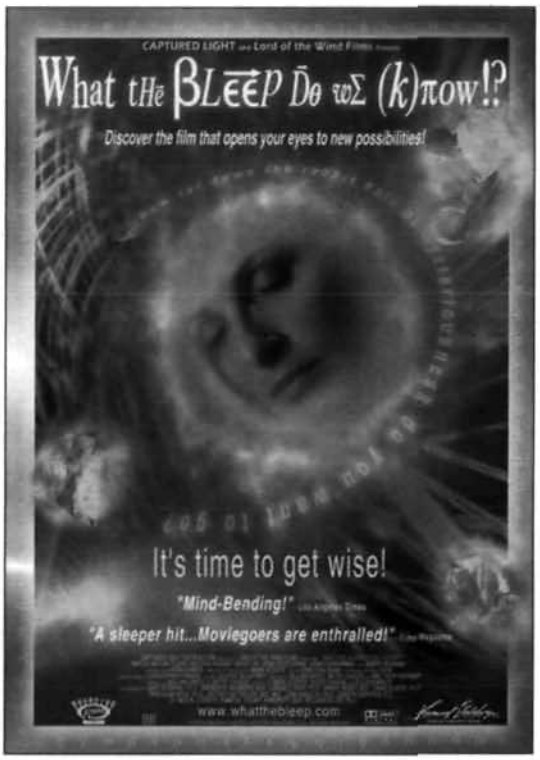
Betty Hill also recalled a "star map" exhibited by one the aliens which she later drew from memory. Subsequently, after a six-year search, an Ohio schoolteacher and amateur astronomer, Marjorie Fish, believed she had found matches for some of the dots and circles on Betty's drawing, including our sun and a planet of Zeta 2 Reticuli that was seemingly the aliens' home base. Noted astronomer Carl Sagan and a Cornell University graduate student reported that a computer plot of fifteen star positions identified by Fish showed "little similarity" to those marked on Betty's drawing.

Betty Hill was not only an excellent hypnotic subject but she also exhibited many other traits associated with a fantasy-prone personality. For years she believed UFOs followed and communicated with her, as she related in her privately published 1995 book, *A Common Sense Approach to UFOs*.

—Joe Nickell

Critics Ravage 'Hoax' New Age Film

An independent film directed and produced by followers of the New Age channeller/guru J.Z. Knight called *What the Bleep Do We Know?* was released last February (and is still in theaters). The film, a bizarre blend of mysticism and quantum physics, has became a minor hit and earned about $4.4 million in the first six months of release. Some of the "scientists" featured were reportedly unhappy with the way they were portrayed by the filmmakers and said that they were not clear what they were participating in. Skeptics were, of course, less than impressed with the film (see review "What the #$*! Do *They* Know?" September/October 2004), but even given the New Agey overtones, audiences and critics have been slow to embrace it.


CAPTURED LIGHT and Lord of the Wind Films present
What the BLEEP Do we (k)now!?
Discover the film that opens your eyes to new possibilities!
It's time to get wise!
"Mind-Bending!"
"A sleeper hit...Moviegoers are enthralled!"
www.whatthebleep.com

What the Bleep?'s director and producers have focused on grassroots publicity efforts and cast themselves as film mavericks who will show up a Hollywood that was not high-minded enough to embrace their ideas. It's perhaps not surprising that a cult-like film would achieve a cult-like following, and it seems that much of the revenue is generated not by new filmgoers but by repeat ones trying to figure out just what the film is trying to say. Meyer Gottlieb, president of independent film distributor Samuel Goldwyn Films, said that he attended a Los Angeles screening and met hundreds of people who "told me that the movie had an impact on their lives. Many had seen it two or three times." One devotee, a sixty-two-year-old Californian who has seen the film twelve times, said, "It's a relief to get out of the [constant] barrage of negative news and explore the deep connections between mind, body and spirit. . . . The movie is such an aberration for Hollywood, a world driven by fear and the bottom line."

Mainstream filmgoers have more or less ignored the film, while the critics have almost universally panned it. Maitland McDonagh, of *TV Guide*, says the film "quickly tumbles down a rabbit hole of annoying psychobabble, dubious science, and embarrassingly silly animation." *Washington Post* critic Michael O'Sullivan described the film as "Part talking-head documentary, part live-action narrative featurette and part goofy animation [that] fails on all three levels...stiffly written, badly acted, choppily edited, and awkwardly redundant...On the whole, it feels like a cross between a PBS special hosted by a series of low-rent Deepak Chopras and an infomercial for self-help audio tapes. Bleep, indeed." Nick Schager of Slant magazine concluded that, "If people are truly able to construct their own destinies, then I can only hope that *What the Bleep*, with its hokey and derivative CGI, John Tesh-influenced score, and screeching electronic sound effects, will beget a future devoid of these filmmakers' creepily cultish work."

Because the reviews have been overwhelmingly negative, ads for the film are deceptive and take blurbs out of context to suggest critical praise. The *Los Angeles Times*, for example, is quoted as calling the film "Mind-Bending!" though a look at the actual review (by Kevin Crust) is decidedly less enthusiastic: "It's easy to question how much further you wish to

go with the movie. . . . The journey produces more questions than answers [and is] a mixed bag . . . fraught with an excessive amount of navel-gazing."

Film critic Roger Ebert called the film a "hoax" and published a reader's comment (apparently one of many) that said, "There's little to no accurate science in the film, and, as a physicist pointed out recently, the individuals who are quoted are pretty far from qualified experts on the field of quantum mechanics. Case in point: One of the persons expounding on causality and quantum physics . . . is a chiropractor." Ebert responded, "I knew there had to be something fishy when the expert who made the most sense was channeling a 35,000-year-old seer from Atlantis."

—Benjamin Radford

Benjamin Radford has been a film critic since 1994; his reviews are available at www.radfordreviews.com.

Paranormal Expo Cancelled Under Cloud

When the promoters of the paranormal-themed Paraworld Expo announced its event at the Los Angeles Convention Center to be held October 21 through 24, 2004, Sherri Andrews and Wendy Hughes of the Independent Investigations Group at CFI–*West* had to see it for themselves. According to the promotional literature, "For the first time in history, ParaWorldExpo LLC will bring together more than fifty of the world's leading pioneers and experts in a vast spectrum of paranormal topics. An estimated 250,000 individuals from around the globe will embark on a four-day adventure." Where else could you find exhibits about ghosts and hauntings, UFOs and extraterrestrials, past lives, mediumship demonstrations, angel communication, and tarot all under one roof? This event would be the Shangri-la of psychics, the Valhalla of remote viewers, the Elysium of exorcists.

Fate stepped in, for the Expo was not to be. When Vaughn Rees of CFI–*West* warned that conference was not listed on the Convention Center Web site, and that the Paraworld Web site had been taken down, Hughes called the convention center in early September and was told that the event was no longer listed on their computer calendar. She and Andrews cancelled the payments for their tickets, and found that the phone numbers for Paraworld had been disconnected.

Leslie Inzunza, who was hired to help organize the event, said she and many others were trying to locate Paraworld organizer Steven Doolittle. Though at least some of the tickets to the Expo have been refunded, as of this writing, several vendors—some of whom paid $2,500 for a booth—are trying to get their money back. Apparently, the participants' powers of perception and prediction were on hiatus when they paid Doolittle for the 2004 Paraworld Expo. Maybe the remote viewers will locate him. . . .

—James Underdown

*James Underdown is Executive Director of the Center for Inquiry–*West *in Los Angeles.*

Raelian Update: Sex, Pseudoscience, and Sacrilege

Raelian Sex

In 1950s sci-fi movies, aliens brought mankind gifts like solutions to world peace and the cure for cancer. In the new millennium, they just want us to have a lot of sex. The October 2004 issue of *Playboy* featured the otherworldly Raelians, a UFO group known for its standards of free and open sexuality as well as its belief that life on Earth was engineered by space aliens. The Raelians are, however, best known for the 2002 cloning scandal, when Clonaid—a company founded by the group's leader, Rael—gained worldwide notoriety for making unsubstantiated claims of having successfully cloned human beings.

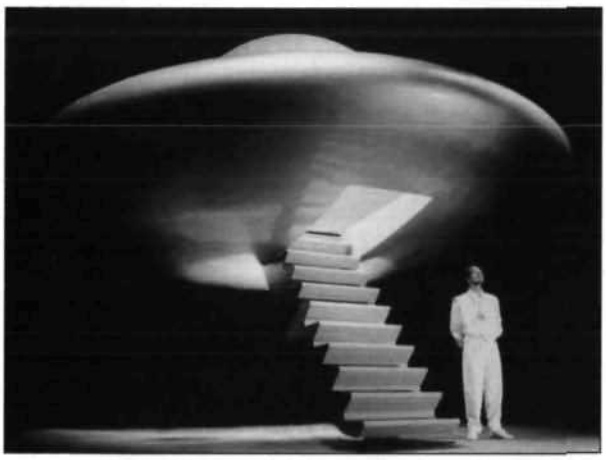
Three Raelian women are featured in the *Playboy* pictorial, including Marina Boisselier, the daughter of Clonaid CEO Brigitte Boisselier, and Sophie, who has been the life companion of Rael for the past thirteen years.

At a September 19, 2004, press conference in Montreal, Rael spoke "on the topic of nudity and spirituality," and praised Hugh Hefner, *Playboy*'s publisher, for "his commendable actions aimed at breaking sexual taboos and for actively taking part in the evolution of lifestyles." Rael awarded Hefner (in absentia) the title of "Honorary Priest." Inquiring minds want to know: will a UFO landing pad be installed at the *Playboy* mansion anytime soon?

Raelian Pseudoscience

The Raelians have recently taken up a new cause, Intelligent Design (ID), and are now actively advocating equal time for ID theory in classrooms around the world. On September 21, 2004, the U.S. Raelian Movement announced that the Raelians support "academic debates" about Intelligent Design and evolution, and equal time for ID in the classroom. A press release cited a recent paper on Intelligent Design by Stephen C. Meyer, director and Senior Fellow of the Center for Science and Culture at the Discovery Institute in Seattle, in which he argues that "no current materialistic theory of evolution can account for the origin of the information necessary to build novel animal forms." The Raelians put a naturalistic—and curious—twist on ID that Meyer and his Discovery Institute brethren might not have anticipated:

> One of the major arguments against The Theory of Intelligent Design has been that it went against the 'naturalism philosophy'. . . . The Raelian Movement would like to underscore that the Theory of Intelligent Design does not lead to a supernatural designer but to an extraterrestrial human civilization designer, which is in line with



Rael, the spiritual leader of the international Raelian Movement, poses in front of a giant UFO. AFP PHOTO/CLONAID

> 'naturalism philosophy.' One day, maybe sooner than you might imagine possible, we will go to other planets and scientifically engineer life on them. Then, probably, these worlds will create deistic religions from the interactions we will have with them. After this, they will develop an evolutionary theory to escape from the supernaturalistic view of their ancestors, and finally, they will discover that life on their planet was indeed designed—but by us, human beings who came from another world, the Earth. . . .

The Raelians plan to launch a series of ongoing debates throughout schools and universities on Intelligent Design, and state that the "whole world" will benefit from a "healthy" educational system where both evolution and ID are taught, arguing that students have "the right to know."

Perhaps the next time Discovery Institute representatives go to school board hearings arguing for the teaching of Intelligent Design, SKEPTICAL INQUIRER readers might make a point of attending and reminding Christian board members and parents in the audience that ID is the "theory" of choice for the largest atheist, pro-cloning, free-love UFO group in the world.

Raelian Sacrilege

Rael stormed off the set of the Quebec television show *Tout le Monde en Parle* (*The Whole World's Talking about It*), after editorial cartoonist Serge Chapleau began to have fun at His Holiness's expense. After making fun of Rael's otherworldly clothing and hairdo, saying "It's an old dream of men to sleep with a lot of loose women at the same time . . . but if I have to wear that suit and hairdo . . . forget it," Chapleau grabbed hold of the tight bun on Rael's head. Rael has filed a complaint against Chapleau for "physical aggression" and written a letter to CBC demanding a public apology.

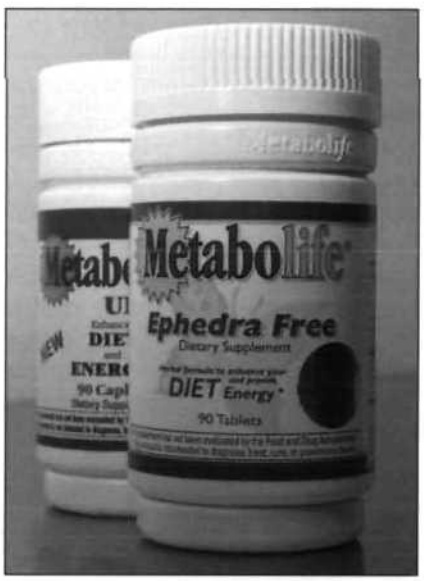
—Kevin Christopher

Kevin Christopher is Public Relations Director for CSICOP.

Metabolife Founder Michael Ellis Charged with Lying to FDA

On top of having the product his company takes its name from banned (see News and Comment, *SI*, March/April 2004), Michael J. Ellis, founder of Metabolife International, is now facing charges of lying to the Food and Drug Administration (FDA) about the safety record of that product, ephedra-based Metabolife 356. In a press release issued by the office of the United States Attorney for the Southern District of California (Carol C. Lam), dated July 22, 2004, a grand jury "returned an eight-count indictment" against Ellis and his company. Ellis and an attorney representing Metabolife entered pleas of not guilty on all counts in federal court on July 27.

Under the original indictment, both Ellis and his company each faced eight charges: six counts of "making false, fictitious and fraudulent representations to the Food and Drug Administration" and two of "corruptly endeavoring to influence, obstruct, and impede proceedings concerning the regulation of dietary supplements containing ephedra being conducted by the FDA." Federal District Court Judge Napoleon Jones has since dismissed the latter two counts because they lacked specificity, and consolidated the other counts, saying that they did not constitute separate acts.



Metabolife 356 was first formulated by Ellis in 1989 and quickly became one of the top-selling diet aids in America. However, dangerously adverse reactions began to be reported by its users and their families, ranging from elevated heart rate to death. In a letter to the FDA in February 1999, Ellis wrote, "Metabolife has never been made aware of any adverse health events by consumers of its products." However, the FDA contends that Ellis had reports of some of these adverse reactions ("at least 138" according to a congressional report released in October 2002), but failed to report them to a congressional investigation. That document also notes that (at the time of that report) "Metabolife records include nearly 2,000 reports of significant adverse reactions to Metabolife products," that "many of the significant adverse events involve consumers who were young, in good health,

and taking recommended dosages" when the events occurred. Furthermore, "Metabolife's handling of the adverse event reports exhibits indifference to the health of consumers" (see www.democrats.reform.house.gov/Documents/20040827102309-56026.pdf for further details of these findings).

Though the ban went into effect in April of this year, the company continues to market other dietary supplements, including non-ephedra-based appetite suppressants and Metabolife Starch Buster, a product the company claims reduces the absorption of carbohydrates.

In a related development, a new study using dogs has provided additional evidence that ephedrine can kill. When the drug was administered to healthy dogs, no bad effects were noted, but when dogs with reversible, artificially induced arterial blockages were given the compound, fibrillation, or elevated heart rates, were observed—in some cases, potentially lethal rates. Arterial blockages can occur naturally in humans without being detected, and, judging by this evidence, anyone with such a blockage who took an ephedrine-based compound for weight loss could be in danger of suffering fatal cardiac arrest. The report was published in the *Journal of the American College of Cardiology* on October 26, 2004.

—David Park Musella

David Park Musella is an editorial assistant with SKEPTICAL INQUIRER.

Psychics (Don't) Explain Missing September 11

While going though files on psychics a few months ago, I came across a newspaper article listing annual psychic predictions—in and of itself, an unremarkable find. The article appeared in the *Weekly Alibi* (Albuquerque, New Mexico) and featured predictions from local psychics for the following year. What made this particular article interesting was the year being predicted: 2001, in an issue dated January 11–17. Dozens of predictions were made; some were right, some were wrong, most of them were obvious, vague, or impossible to verify. But all the psychics somehow missed what in retrospect was the most important event of 2001, a watershed moment in American (and indeed geopolitical) history: the terrorist attacks of September 11.

There were five psychics featured in the *Alibi* piece; one of them is conveniently anonymous (he goes by "N."), and another has since died and therefore can't answer questions. The remaining three are described in the article:

"Alan Oken is a psychic and social commentator 'whose real work is in the development of consciousness.' He has been in the field for more than thirty years, has written twelve books, speaks seven languages, and lectures worldwide six months out of the year.'"

"Martha Woodworth is a tarot reader and astrologer specializing in career, creativity and relationship advice. She has twenty years' experience in the field and has taught the psychic crafts at Santa Fe Community College for seven years. She is also a psychic detective who has appeared on *Unsolved Mysteries*, was the 'Psychic Adviser' columnist for *New Woman* magazine."

"Stan Alexander is a local psychic specializing in private readings—tarot, palm, runes, and numerology. He has been featured in several international publications and television programs and has been a headlining entertainer at nightclubs and other venues across the country."

As the third anniversary of the attacks approached, I contacted the remaining three by e-mail on August 18, 2004, to ask about their spectacular failures: "I read through all of them, and couldn't help but notice that you (and all the other psychics) somehow missed the Sept. 11 terrorist attacks. I was wondering if you had any explanation or comment on this, as it seems very strange that so many prominent psychics would all miss such an event of global importance."

All three gamely replied:

Alan Oken stated that, "Simply stated—I am not a psychic and did not make any psychic predictions." (This is a curious statement, given that the article clearly refers to him as a psychic and lists "Alan Oken's Predictions.")

Martha Woodworth wrote only, "No. I don't [have an explanation]."

Stan Alexander, voted "Best Psychic" in a 1999 poll of the newspaper's readers, suggested that he did in fact have an inkling of the events but did not want to publicize the results of his prophetic gift: "While many, including myself, may have had intuited something along those lines taking place, it is not something that one puts out as it can cause too much potential alarm and panic. Anybody demonstrating responsibility will know that predictions are not an exact science and as such, caution in what is to be put in print must be demonstrated." (He had information that might have saved thousands of people's lives and changed the course of history but didn't want to create alarm and panic?)

I did a Web search and found the article online at http://alibi.com/alibi/2001-01-11/feature_section.html. The predictions had been easily available for the world to see since January 2001. Oddly, only a few weeks after I asked the psychics about their failed predictions, the page had been removed from the *Weekly Alibi* Web site (those from other years are still there). This action may just be a coincidence, or perhaps the *Weekly Alibi* received a request from one of the embarrassed psychics who asked them to remove his or her glaringly wrong predictions. Though much harder to find, the site is archived elsewhere and still accessible at http://web.archive.org/web/20010420235304/http://www.alibi.com/alibi/2001-01-11/feature_section.html#feat.

—Benjamin Radford □

Mystery Painting: 'The Shadow of the Cross'

An enigmatic painting is exhibited at the church of San Francisco de Asis (St. Francis of Assisi) at Ranchos de Taos, New Mexico (figure 1). It depicts a barefoot Jesus standing by the Sea of Galilee; however, when the lights are extinguished, the background luminesces as if the sky and sea were shining in moonlight, and the figure becomes silhouetted, a cross appearing at the left shoulder and a halo over the head (Michell 1979, 94; Colombo 1999, 70–72). (See figure 2.) Other mysterious effects are sometimes reported as well.

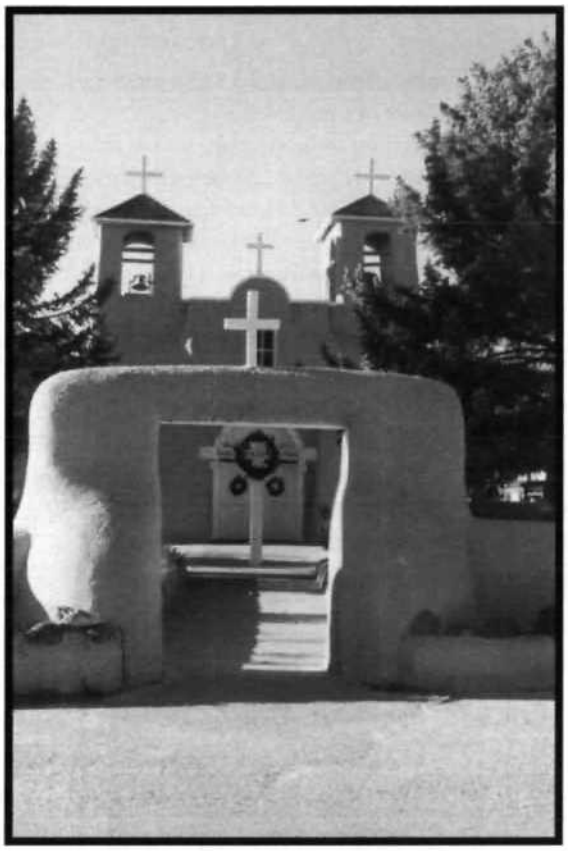


Figure 1. Historic mission church of San Francisco de Asis in Ranchos de Taos, New Mexico, is home to a "mystery painting." (Photo by Joe Nickell)

Background

Known as "The Shadow of the Cross," the life-size painting was created in 1896 by an obscure French-Canadian artist named Henri Ault (d. ca. 1912), who had a studio in the Cobalt, Ontario, region (Rawson 1914, 615–616). Ault is said to have denied being responsible for the effect, which he claimed to have discovered (quite fortuitously) upon entering his studio one night. "He believed he was going mad, and he was never able to explain the reason for the transformation," states writer John Michell (1979, 94).

Reportedly, British scientist and gullible spiritualist William Crookes (1832–1919) was the first to attempt—unsuccessfully—to explain the painting (Michell 1979, 94), which toured Europe and was supposedly an attraction at the 1904 World's Fair in St. Louis. A church brochure claims: "It is not known what causes the background to be luminous. It was painted before radium was discovered and when tested with Geiger counters the results have been negative" (Shadow n.d.).

Sources even allege that more extensive scientific examinations have been conducted, utilizing "Geiger counters, light tests and scrapings"—all to no avail (Michell 1979, 94). However as reported by *New Mexico Magazine*, while a church archivist claimed the painting had once been analyzed "for all known luminescent substances," she conceded "she had no documentation of the testing and was not sure who did the test or when" (Gaussoin 1998). Such alleged analyses appear to be apocryphal, representing attempts to convince the credulous that science is trumped by supernatural mystery.

In 1948 the picture was donated to the church, and in the early 1980s it was relocated in a room of the adjacent parish hall, furnished with folding chairs. A videotape provides an introduction to the local parish.

When the lights are turned out, and the background begins to glow, subjective impressions can prevail. Observes one source (Crystal 2003): "Soon the silhouette of Jesus grows three-dimensional and appears more

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like a dark statue than flat image. His robes seem to billow in the breeze. . . ."

The church takes a cautious view of the phenomenon, and there are no reported healing cures associated with the painting. Pilgrims' reactions vary. Some exclaim "It's a miracle!" says archivist Corina Santistevan. "There are those who are very touched and very moved and very reverent," she says. "And those who continue to be skeptical. And those who are curious and want a scientific explanation" (Chavez 2002).

Investigation

I was among the latter group. I visited the historic church on October 27, 2003, accompanied by colleague Vaughn Rees. While photographs—and certainly actual examinations of the painting—are not permitted, we managed to get a close look by staying for two showings and the interval between.

Some of the picture's touted mysteries are easily explained, such as our docent's claim that Jesus' eyes follow the viewer wherever he or she stands. That is merely the result of a three-dimensional view being "fixed" in a two-dimensional representation, and any such portrait in which the subject's eyes gaze directly at the viewer will produce the same effect (Nickell 2003).

The picture is also said to appear more intense the longer one views it, but that would be expected due to the viewer's eyes becoming accustomed to the dark. In the mottled background of the painting, some see a boat, angels, or other images, but these are simply simulacra: pictures perceived, Rorschach-like, in random patterns. Some people report seeing the image of Jesus "vibrate," the docent told us; however, that is attributable to the well-known autokinetic effect, in which a stationary light in the dark appears to be moving, due to slight, involuntary eye movements (Schick and Vaughn 1999, 45). All such effects may be augmented by the power of suggestion.

Regarding the appearance of the halo and cross, it must be noted that—contrary to some sources (e.g., Michell 1979, 94; Crystal 2003)—the halo is *always visible*, consisting of a simple outlined ellipse. It merely becomes silhouetted when the background luminesces. Such an effect—as my own experiments demonstrated—could easily be created by painting the halo outline with ordinary, opaque paint over a background rendered with a phosphorescent (glow-in-the-dark) one.

The same principle could explain the appearing-cross effect, except in that case the phosphorescent paint would need to *visibly match* that of the non-glowing background areas—something easy for an artist to accomplish. This was my preferred hypothesis to explain the mystery, after I first learned of it from Canadian writer John Robert Colombo (1996).

Supporting this hypothesis is the observation that the painting's background—in contrast to the other areas—is badly cracked and flaking, consistent with its having a different composition. (Underneath, where the upper layer has flaked off, is a very bright blue, whose presence suggests the picture was repainted—as with a phosphorescent paint.)[1] Further corroborative evidence comes from the fact that the glowing of the paint begins to diminish after a few minutes—just like phosphorescent paint—and must be re-exposed to light for the effect to continue (Casper 2004).

Proponents' insistence that the picture was created before radium was discovered (by Pierre and Marie Curie in 1898) is largely irrelevant, since non-radium luminous paints had long been available commercially. The first, Balmain's paint (a calcium sulfide phosphor to which was added a small amount of a bismuth compound as an "activator") appeared in 1870 (Phosphorescence 1911; Luminescence 1960). In 1879 an English patent was awarded "for the use of phosphorescent salts, such as sulphid [sulfide] of lime, of strontium, barium, etc., for the purpose of illumination by mixing them with paint or varnish . . ." (Phosphorescent 1879).[2]

Although in 1896 Ault's "The Shadow of the Cross" was a novelty, some modern artists now produce luminous paintings as a special genre (Duffy 1995), and there are commercial transformational pictures (such as a "daylight" seascape that, in the dark, becomes a "sunset" scene using four glow-in-the-dark colors [Spilsbury 1997]).

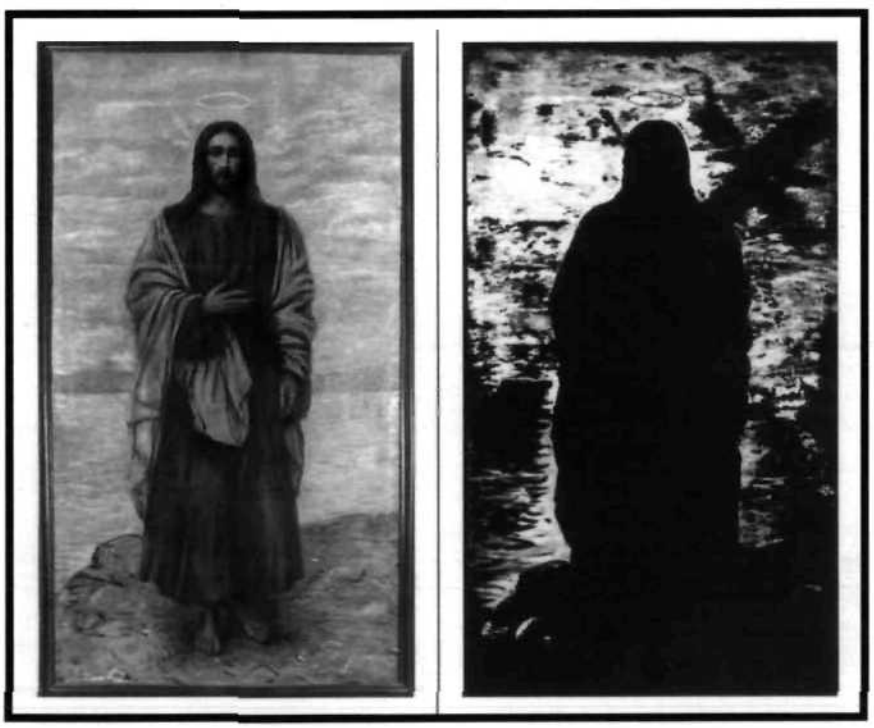

Figure 2. Before-and-after photos of the transformational painting, "The Shadow of the Cross," illustrate a mystery that supposedly baffles science. (Photos reproduced courtesy of Sarbo Photography, Albuquerque, N.M.)

MYSTERY PAINTING: 'THE SHADOW OF THE CROSS'

Continued on page 21

Hurricane Osama?

With the recent devastating and remarkable assault on Florida by one destructive hurricane after another, some are questioning whether there might not be some yet-unexplained *reason* behind so much misery. Joseph Trainor, editor of the Webzine UFO Roundup, observed that "The band of high pressure in the Atlantic stretches from Cabo Verde all the way to Florida, which is really unusual . . . it creates a kind of 'conveyor belt' carrying the storms all the way across and then shooting them up into the Caribbean" (see www.ufoinfo.com/roundup/v09/rnd0938.shtml). What could be the cause of this? One possibility is suggested by the fact that UFO Roundup received three emails from readers who claimed to have heard the High Frequency Active Auroral Research Program (HAARP) broadcasting from Alaska on September 14, on a frequency of 3.390 MHz. HAARP is an unclassified program managed by the Air Force Research Laboratory and the Office of Naval Research (see www.haarp.alaska.edu/haarp/faq.html). But according to conspiracy theorists, it is also involved in mind control and weather modification. Wearers of tinfoil hats presumably wear them to block signals from HAARP (which are just high-powered short-wave radio transmissions). "Personally I don't think HAARP has the power to 'steer' a hurricane," said Trainor. "But the Tuesday burst might have deflected [hurricane] Ivan away from its original projected landfall around Tampa."

Yet Trainor can suggest another even more remarkable theory: "Other than aliens, I can think of only one source able to create and sustain that unusual Bermuda High over the Atlantic—Shambhala, the hidden city of mystics in Afghanistan. Shambhala is reputed to have access to the weather-modification technology of ancient Atlantis. There have also been reports of Osama Bin Laden hiding out occasionally in Shambhala. Osama might have persuaded the Shambhalans to use 'weather warfare' against the USA. Is it just a coincidence that the 'hurricane blitz' began on August 3, the same date Allied forces stepped up their offensive in Afghanistan? . . . I just find it extremely interesting that Hurricane Ivan's worst fury descended upon the old Jewish synagogue in Pensacola, Fla., as if Osama planned it that way."

Evidence of another quite inexplicable conspiracy at work has just recently come to light. On September 28, Dr. John Mack, Professor of Psychiatry at Harvard University and one of the leading promoters of "UFO abduction" stories, was struck by a car and killed while crossing a street in London (see News and Comment, page 9). Mack was in London to speak at a conference about T.E. Lawrence ("Lawrence of Arabia"), about whom he had written a Pulitzer Prize-winning book (see www.johnemackinstitute.org). The incident seems to be a random tragic accident, as Mack was in a crosswalk and the driver was reported to be intoxicated. But almost immediately, some UFOlogists began to speculate that *somebody* must have wanted Mack dead, apparently because he knew too much about flying saucers. Within a day of Mack's death, a note was widely circulated on the Internet from somebody purporting to be "British Higher Intelligence Agent X." X says, "There's something circumstantially very odd here. Why was Mack alone in a deserted area almost totally unknown to him? For a planned hit, the Totteridge area of Mack's travels from his London dinner would be the perfect time and place. Car accident? You would have to try very hard to get hit by a car at night in this area. It is almost totally deserted at night, being right by three of the biggest reservoirs in Britain. The vast waters would have been a perfect entrance and exit route for a hit team in silent electric dinghies." The San Francisco Bohemian physicist Jack Sarfatti commented, "As Agent X says: What was John Mack doing alone late at night in such a god-forsaken place? I have recently returned from Britain myself and I would never have been

Robert Sheaffer's World Wide Web page for UFOs and other skeptical subjects is at www.debunker.com.

alone in such a place late at night. Something stinks here." Now all that remains to be explained is why anyone would want to assemble a hit team to attack an eccentric old professor whose pronouncements about UFOs had gotten so bizarre that practically nobody took him seriously any longer.

Similar conspiracy claims surround the May 14, 2004, death of Eugene Mallove, the editor of *Infinite Energy* magazine, a major promoter of claims about "cold fusion." Mallove, who had been overjoyed to hear in April that the U.S. Department of Energy had agreed to give "cold fusion" yet another review, was badly beaten while cleaning up a vacated rental house in Norwich, Connecticut, owned by his mother (see News & Comment, Sept./Oct. 2004). Police believe that robbery was the motive. His vehicle was stolen but recovered nearby, and investigators believe that his death may be related to two other murders in the area (see www.wfsb.com/Global/story.asp?S=2092115). Police suspect that his killer may have been Jarion Childs, a former college basketball star who was killed while attempting to rob a Dairy Queen in Connecticut on June 28. Childs was shot while reportedly beating the owner of that establishment with a crowbar. However, many conspiracy theorists insist that Mallove was killed because he knew too much about "cold fusion" (see, for example, www.greatdreams.com/mallove.htm and www.abovetopsecret.com/forum/thread50762/pg1). Norwich police Lt. Timothy Menard was quoted in *The Boston Herald* on May 18: "There are tons of people calling saying he may have been on the verge of a great discovery. We don't feel (a conspiracy is) the case at this point." However, Menard added that "We haven't ruled out any possibility."

• • •

Paranormal monsters continue to menace South America. In my last column (November/December 2004, page 20), I wrote about the "winged dogs" and flying "dog-faced kangaroos" that have been troubling certain residents of Chile. Now in Argentina, several employees of a fish hatchery have reported, according to the *Diario El Tribuno* (Salta, Argentina) on September 22, a "large serpent with a hairy head and reddish eyes" that reportedly emerged at night from a brick shack. "We were baking bread when my wife saw the head of this veritable monster emerging from between the holes in the wall of a brick shack," said Jose Venticola. "I was paralyzed. It had a snake's head, but hairy, with red eyes and a piercing gaze." They called out firefighters to hunt the creature, but like all paranormal monsters it was never found (see www.virtuallystrange.net/ufo/updates/2004/sep/m23-027.shtml).

But some solid paranormal evidence may at last be forthcoming. *UFO Magazine* in Brazil reports that a "Skeleton in Brazilian museum might be of an alien being" (see www.virtuallystrange.net/ufo/updates/2004/oct/m06-017.shtml). At the privately owned Wilson Estevanovic Museum of Natural History in the city of Uberaba, which had its origin in a collection of artifacts exhibited in nineteenth-century circuses, a bizarre-looking skeleton is said to be giving visitors the willies. It is apparently an embalmed skeleton that had been in the family's possession for ninety-six years. The Estevanovic family does not know where the piece comes from or how it was embalmed, but they believe it is more than 200 years old. The creature has an extremely large head for its size. One doctor said that the carcass "seems to have belonged to a hermaphrodite with six-fingered feet. . . this being had multiple anomalies. The most evident ones are the presence of hydrocephaly and palate-labial fissure." However, many people who have seen the being are convinced that it is an extraterrestrial creature. Veruska Estevanovic, a biology student at the University of Bahia and the granddaughter of the museum's founder, concluded after her own investigation that the skeleton probably belongs to an extraterrestrial. A.J. Gevaerd, the editor of *UFO Magazine* of Brazil and the founder of the *Brazilian Center for Flying Saucer Research*, says that he is assembling a team to study the creature, with the full cooperation of the museum owners.

Another "classic" UFO photo has joined the ranks of admitted hoaxes—at least for a few weeks, anyway. On February 15, 1954, a thirteen-year-old British schoolboy named Stephen Darbishire and his eight-year-old cousin Adrian Meyer were out strolling in the hills near Coniston, in the Lake District, when they used an "old-fashioned" Kodak box camera to snap two photos of an alleged "flying saucer" that had supposedly landed nearby. The photos, which closely resembled those published by the California UFO contactee George Adamski, quickly became a national media sensation. It was said to be the first photo of a flying saucer taken in Britain. The object in the photos looks implausible in the extreme: flat, silvery, and out-of-focus. Desmond Leslie, the British UFOlogist who was Adamski's colleague and co-author, quickly traveled to Coniston to interview the boys at length. Leslie noted that the boys kept a consistent story when interviewed by four hardened journalists from the BBC, and he cited their story and photos as strong confirming evidence of Adamski's tales. Leonard G. Cramp, an aeronautical engineer, wrote a bizarre 1955 book titled *Space, Gravity, & The Flying Saucer* in which he used a system called "orthographic projection" to prove that the object depicted in the Darbishire and Adamski photographs were proportionally identical. When Stephen and his father were visiting London in March 1954, they were quietly escorted to Buckingham Palace to meet with one of Prince Philip's private secretaries. The London *Sunday Dispatch* got wind of this meeting and reported (March 24, 1954) that the queen's husband had invited their visit because he wanted to know more about the saucer incident.

For an example of UFOlogists who take the Darbishire "landing" quite seriously, see www.ufoinfo.com/roundup/v04/rnd04_07.shtml and www.algonet.se/~hermesat/adamski.htm. The case is discussed in NICAP's classic 1964 "UFO Evidence" by Richard Hall, but Hall does not reach a firm conclusion about whether the photos are genuine or not. Over the years, Darbishire has

alternately stuck to his story, then proclaimed it a hoax, and later claimed that the "hoax" was itself a hoax. Darbishire, now a sixty-three-year-old artist and retired teacher, admitted in an interview published September 10 that the saucer photos were a "schoolboy prank," saying that when confronted by the national media, he was "too terrified" to confess, and so he continued the deception. Another local artist, Julian Claxton, recently re-created the photos to show how the hoax had been done, for the sake of "art" (see www.nwemail.co.uk/news/viewarticle.aspx?id=143262). He used a fishing pole, a wooden frame, and a silvery UFO-shaped object. However, by the time that Claxton was ready with his extraterrestrial performance art on October 8, Darbishire had changed his story yet again, now claiming that the photo had "definitely" not been faked (see www.thisisthelakedistrict.co.uk/news/lakes/display.var.534272.0.coniston_old_man_to_host_artist_and_ufo.php). Some deep-thinking UFOlogists agonize over whether or not to accept Darbishire's on-again, off-again confessions of a hoax, as if the photos themselves were not implausible enough, and as if a witness who keeps changing his story should be believed when he makes any extraordinary claim. Some suggest that Darbishire's UFO encounter and photos may somehow be too deep and profound for simplistic words like "true" or "false" (see, for example, www.flyingsaucery.com/brigantia/brigmain.htm). □

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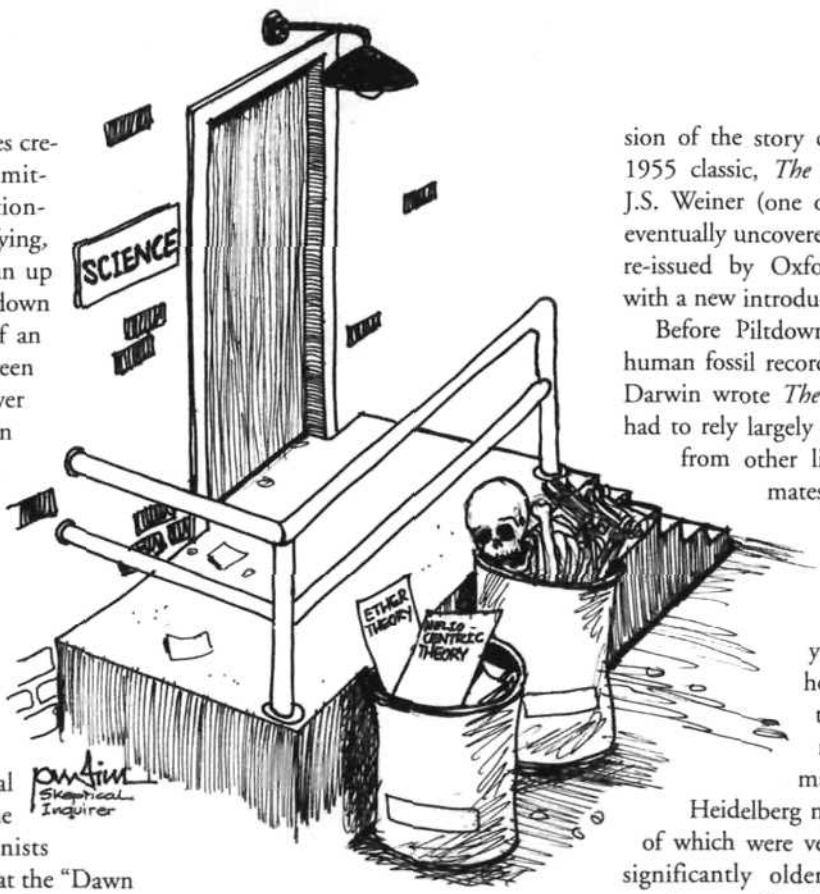
Piltdown and How Science Really Works



When one debates creationists (admittedly a questionable, yet often very satisfying, habit), one is bound to run up against the infamous Piltdown forgery. This is the case of an alleged missing link between humans and so-called lower primates, that was found in England (near Piltdown, in fact) and announced to the world on December 18, 1912. The announcement was made by Arthur Smith Woodward, a paleontologist of the British Museum of Natural History, and Charles Dawson, a local amateur paleontologist, the actual discoverer of the fossils. The problem is—as creationists never tire to point out—that the "Dawn Man of Piltdown" (scientific name *Eoanthropus dawsoni*, in honor of its discoverer) turned out to be a fake. Moreover, it took scientists four decades to find out! See what happens when one takes the doctrine of evolution on faith, as one's secular religion? QED.

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Many scientists are rather embarrassed by the Piltdown debacle, somehow managing to feel guilty and indirectly responsible for whatever goes wrong in their chosen profession.

And yet, as I shall endeavor to explain, Piltdown should be presented in all introductory biology textbooks as a *perfect example of how science actually* works! Let us briefly see how the hoax unfolded. A complete and engaging version of the story can be found in the 1955 classic, *The Piltdown Forgery* by J.S. Weiner (one of the scientists who eventually uncovered the truth), recently re-issued by Oxford University Press with a new introduction and afterword.

Before Piltdown, very little of the human fossil record was known. When Darwin wrote *The Descent of Man*, he had to rely largely on comparative data from other living species of primates, for only the clearly almost-human Neanderthals were known to paleontologists. A few years before Piltdown, however, two important discoveries were made: that of Java man in 1891 and Heidelberg man in 1907, neither of which were very ancient. When a significantly older set of prehuman remains was allegedly found at Piltdown, the scientific world was simply ready for the discovery. It was what practitioners in the field had expected, something that surely the perpetrator of the hoax knew very well.

Supposed evidence of Piltdown man was found on more than one occasion at two separate sites: fragments of skulls, of a lower jaw, and even of stone tools associated with the "culture" of these predawn men. While there were skeptics from the beginning, the hoax was simply

too elaborate and cunningly put together to raise the suspicion of a significant number of paleontologists. National pride probably also played a role in a professional establishment that at the time was dominated by British scientists, with the British Museum being the epicenter of all the activities surrounding the study of the Piltdown fossils.

Yet suspicions about the authenticity of *Eoanthropus dawsoni* grew, until a group of researchers, including Wilfrid Le Gros Clark, Kenneth Oakley, and Joe Weiner, applied stringent chemical tests to the remains, demonstrating that the "fossils" had been planted and chemically altered to make them seem appropriately ancient: the Dawn Man was nothing but a perfectly ordinary human skull paired up with a somewhat unusually small jaw from an orangutan. What Weiner and colleagues couldn't say for sure was who carried out the hoax, although a strong case was then made by Weiner in his 1955 book that the perpetrator was none other than Dawson himself. [See also review of Miles Russell, *Piltdown Man*, on p. 50.]

Be that as it may, what does this story tell us about how science works? Well, on the negative side, it is painfully clear that science depends on an assumption of honesty on the part of its practitioners. Peer review is focused on uncovering methodological or reasoning errors, not possible frauds. But since science is, after all, a human activity, egos, money, and the search for glory—however brief—are still to be reckoned with. As Piltdown and other forgeries have shown, scientists are continuously open to the possibility of someone fooling them by not playing by the rules of the game.

On the other hand, science is a social activity unlike any other that human beings engage in: it is a game of discovery played against a powerful but neutral opponent, nature itself. And nature cannot be fooled, at least not for long. The reason suspicions kept mounting about the true origin of the Piltdown remains was that the more paleontologists uncovered about human evolution, the less Dawn Man seem to fit with the rest of the puzzle. In a sense, the very factor that made the acceptance of *Eoanthropus dawsoni* so fast in the beginning—because it seemed to be the much sought-after "missing link" in human evolution—was also the reason why, four decades later, scientists kept pursuing the possibility that it was not genuine after all. While four decades of delay may seem an inordinate amount of time, they are but the blink of an eye when compared to the history of the human quest for knowledge. Moreover, it is important to note that it was *scientists* who uncovered the hoax, not creationists, which is both an immense credit to the self-correcting nature of science and yet another indication that creationism is only a religious doctrine with no power of discovery.

This is, then, why Piltdown—far from being an embarrassment—should be prominently featured in biology textbooks: it is an example of how the nature of science is not that of a steady, linear march toward the Truth but rather of a tortuous road, often characterized by dead ends and U-turns, yet ultimately progressing toward a better, if tentative, understanding of the natural world. □

MYSTERY PAINTING: 'THE SHADOW OF THE CROSS'
Continued from page 16

Conclusions

Evidence suggests that despite his reported protestations to the contrary, artist Henri Ault deliberately and cleverly created "The Shadow of the Cross" effects. Just such a metamorphosing picture could have been accomplished using glow-in-the-dark pigments or paints that were well known and even commercially available at the time the painting was produced. It is no longer much of a mystery and certainly no miracle, notwithstanding the disingenuity with which the painting's custodians claim science is baffled while at the same time avoiding the testing that could lay the matter to rest.

Acknowledgments

In addition to Vaughn Rees and John Robert Colombo, I received research assistance from Timothy Binga and Benjamin Radford. Philip Befumo, Jr., Product Manager of United Mineral & Chemical Corporation (Lyndhurst, N.J.), generously provided a phosphorescent pigment for my experiments. I am also grateful to Paul Loynes for word processing and Lisa Hutter for photographic assistance.

Notes

1. Vaughn Rees used a hand-held ultraviolet lamp (both short-wave and long-wave) to examine the area around the cross but the UV showed nothing remarkable.

2. One source claims that any known luminous paint should have ceased to be phosphorescent by now due to oxidation (Shadow n.d.). Be that as it may, paintings are often given a protective coat of varnish (Laurie 1967, 169–171) which can improve the longevity and brightness of luminous paints (Phosphorescent 2003).

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Facts and Fiction in the Kennedy Assassination

November 1963, John F. Kennedy and Jackie in the presidential motorcade. Credit: 1963 Art Rickerby/Black Star

Investigating historical mysteries is, possibly, one the most fascinating and rewarding aspects of the work of a skeptical researcher. Mysteries that appear to have no possible solutions, that could certainly be termed "cold," can, sometimes, become clearer thanks to a more careful investigation of the original sources and also to the advancements of science. Think only of the many historical enigmas and crimes that DNA-testing techniques have helped to solve, like the riddle of Anastasia Romanoff's claimed survival (Gill 1994, 1995) or the real origins of Kaspar Hauser (Weichhold 1998).

However, cases are often made more difficult to solve when facts get confused with imagined realities and unfounded conclusions. Eyewitness testimonies and self-styled experts, even in good faith, can alter details and hide important clues that—if untouched—could lead to radically different conclusions. In order to give you some clear examples of what I mean, I will examine one of the great tragedies of the twentieth century.

The Day JFK Died

Hundreds of books and thousands of articles have been written about the tragic death of President John Fitzgerald Kennedy, and it would take a few complete issues of SKEPTICAL INQUIRER just to deal with the more relevant matters involved in the case. I will outline several examples of bad research involved in popular investigations of this case.

Let's get back to that fatal day, November 22, 1963. President Kennedy arrived in Dallas, Texas, during the election campaign. In 1964, there would have been new elections, and Kennedy, who wanted to be sure to be re-elected, had started a tour of the southern states, the most conservative ones, where he was less popular due to his progressive ideas.

It was decided that a motorcade would be conducted through the city. Kennedy and his wife would be in the backseat of the presidential limousine, and Governor Connally and his wife would sit in front of them.

Dealey Plaza, in downtown Dallas, is a large, basin-like square where three roads converge toward an underpass that leads to a freeway. The Presidential limousine entered the plaza, moved slowly along Houston Street, then took a left turn right in front of the Texas School Book Depository building.

It was thirty minutes past noon. What happened next was documented by a movie buff, Abraham Zapruder, who was filming the motorcade with an 8 mm movie camera. The film is silent, for there was no audio on home-movie cameras back then. During the shocking sequence, the President can be seen waving to the crowd, but then he is hit by something and brings his hands to his neck, right in front of him. Governor Connally starts to turn and shake, he is hit as well. Then, there is a fatal shot to Kennedy's head. He died soon after at the hospital.

Who killed him? It was soon determined that the shots came from the sixth floor of the Book Depository. There, piles of boxes were found, stashed around a window, creating a "sniper's nest" with a clear view of the site of the shooting. A rifle was also found that had just been fired along with three spent cartridge shells.

After about two hours, a suspect was stopped. He had had a confrontation with the police inside a movie theater, and it was later found out that he had just shot dead a policeman who had stopped him on a nearby street.

His name was Lee Harvey Oswald; he was a young man who worked at the depository and had been seen on the sixth floor of that building just minutes

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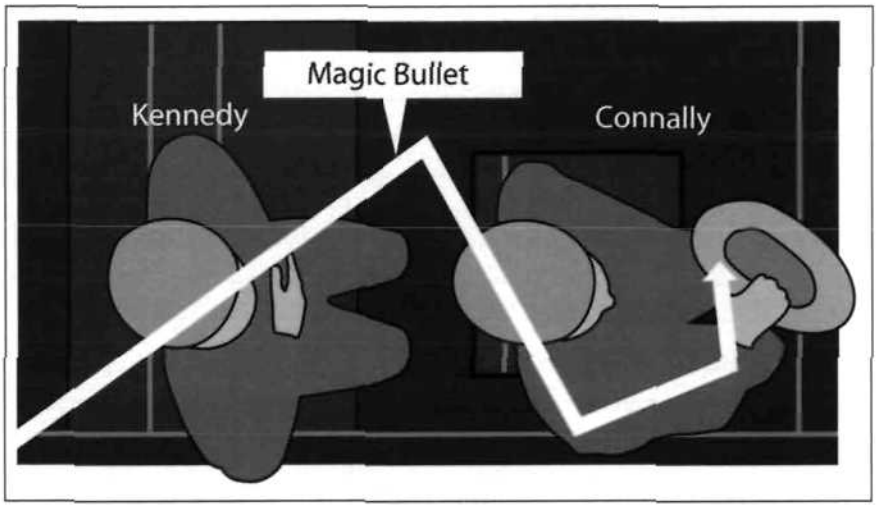

Figure 1. The hypothetical trajectory of the "magic bullet" as presented by various authors (Garrison 1988, Groden 1989).

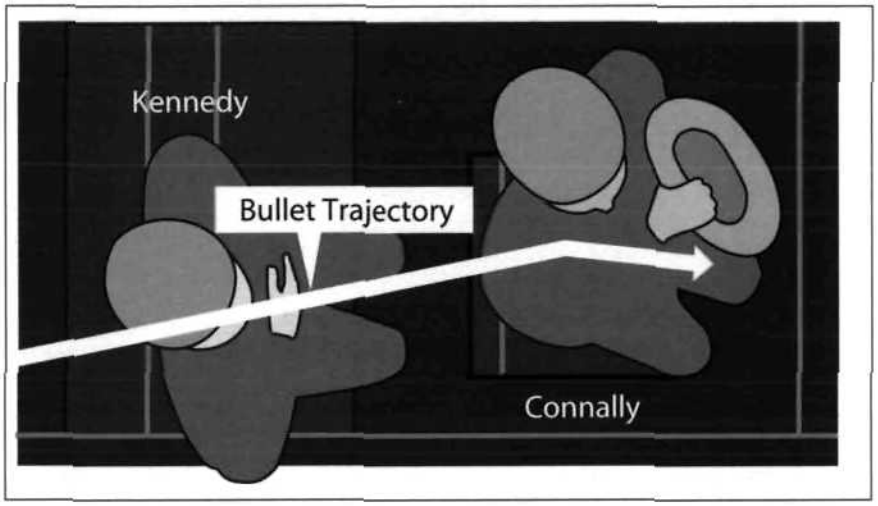

Figure 2. The real trajectory, plotted in accordance with the exact postures of Kennedy and Connally, was not significantly altered until the bullet was slightly deflected by Connally's rib. (Images adapted from Posner 1993)

before the shooting. After that, he disappeared, and he turned out to be the only employee absent from the depository for no legitimate reason.

Oswald was an ex-marine and communist sympathizer. The evidence against him quickly piled up, but only three days after his capture, during his transfer to a police van that would escort him to a more secure prison, nightclub owner Jack Ruby shot him dead.

Those of you who have seen the Oliver Stone movie *JFK*, where this story is told in great detail, will remember the many contradictions coming out of the official investigation of the assassination. I have seen that movie as well, and, like anyone else, I couldn't help but be convinced that Oswald could not be the only assassin. There had to be more than one killer, and this meant that there had been a conspiracy plot to kill the president.

At least, I believed that until I started to research the story for my latest book (Polidoro 2004), and the strangest thing to me was that the deeper I went into it, the more the Oliver Stone version of the story looked weirder and weirder.

I can't go into the countless details here, as I have done in the book, but I'll give you just a couple of examples of the kind of pitfalls into which a historical investigator can easily fall.

I Saw It; I Was There . . .

Most strange phenomena and conspiracy theories rely on eyewitness testimony. Psychologists are aware of the many limits of memory and perception—and the fallibility of eyewitness accounts (Loftus 1980, 1996).

One of the best-known witnesses to the assassination, and the only one who is also the author of a book from the point of view of an eyewitness, was a woman named Jean Hill (Sloan and Hill 1992). She can be seen in the Zapruder film, standing beside a friend.

In her testimony, told and retold over the last forty years, she claimed among other things that she was looking at the limousine where she saw Kennedy and his wife, Jackie; the couple was "looking at a little dog between them," a "white fluffy dog." Hill then jumped to the edge of the street to yell, "Hey, we want to take your picture!" JFK turned over to look at her. At that point, he was shot, and Jackie shouted, "My God, he has been shot!" Then, Mrs. Hill said that she saw "some men in plain clothes shooting back" and "a man with a hat running toward the monument" on the other side of the plaza on the so-called "grassy knoll." Immediately, she started running after him, thinking he was involved in the shooting. "When I ran across the street," she specified, "the first motorcycle that was right behind the President's car nearly hit me."

Thus, she was the first person to run up the grassy knoll, and many followed her. However, the man ran off and she missed him. She was convinced that this man was Jack Ruby, the club owner who, in three days, would kill Lee Harvey Oswald.

And there we have our proof for the existence of a conspiracy.

This, however, is one of those rare occasions in which dozens of reporters and photographers are present on the scene of an event and so there are countless statements on record from eyewitnesses and pictures from every angle. Thus, we can compare Jean Hill's memory with actual facts.

- She said that she was looking at the limousine.

  In the film, you can see that when Kennedy is shot the first time, she is looking away from him.

- She said that the couple was "looking at a little dog between them," a "white fluffy dog."

  There was no dog between them, just a bunch of red flowers.

- She said that she "jumped to the edge of the street" to yell, "Hey, we want to take your picture!" and JFK turned over to look at her.

The Zapruder film shows that Hill never moved or said a word—and the President did not turn to look over. In fact, he had just been shot when he passed in front of her.

- She said that Jackie shouted, "My God, he has been shot!"

Jackie and the car's four other witnesses deny that Jackie said anything.

- She said that she saw "some men in plain clothes shooting back."

But in an interview recorded just forty minutes after the assassination by a Dallas television station, she was asked: "Did you see the person who fired the—" And she answered: "No . . . I didn't see any person fire the weapon . . . I only heard it."

- She said that she immediately started running after the "man with a hat," thinking he was involved in the shooting. "When I ran across the street," she specified, "the first motorcycle that was right behind the President's car nearly hit me."

But as can be seen in the many pictures taken during those fatal moments, she stands still at her place as the limousine and the motorbikes pass by. She even sits on the grass while all of the cars of the motorcade proceed behind the President's limousine.

- She also specified that after jumping into the middle of the road, she was the first person to run up the grassy knoll, and many followed her.

In photographs, you can see a lot of people running around the area and up to the grassy knoll, but Hill always stays in the same spot, probably shocked by the whole thing, like most of the people present.

- She was convinced that the man she had followed was Jack Ruby.

At that precise moment, Ruby was witnessed by many to be at the offices of the *Dallas Morning News*.

Now, as we can see, facts contradict many details of Jean Hill's dramatic testimony. Aside from excusable mistakes and errors made in good faith, we have here a story that, over the years, has changed and grown out of proportion, to the point that Mrs. Hill became a sort of celebrity, invited to every meeting of JFK buffs, and was even depicted in Oliver Stone's movie. She is the proud holder of a card bragging that she was the "closest witness" to the President at the time of the fatal shot to the head. It is quite clear what happens to some people when they find themselves right in the middle of history and have absolutely no role in it. They imagine one.

This Must Be So; I Know. . .

Imagined testimonies are just one of the many problems that an investigator of historical mysteries has to deal with. Another one is "imagined experts," that is, self-styled experts with no real expertise in the chosen field except what they think is "common sense." The Kennedy assassination presents dozens of such cases, but one of the most popular involves the so-called "magic bullet."

The Warren Commission that investigated the Kennedy assassination concluded that the reactions of Kennedy and Connally occurred too close together for two separate shots, even from the same gun, to have been responsible for their wounds. They almost seem to react at the same instant, in the enhanced version of the film seen by the commission. They concluded that one, single bullet caused the injuries to both the President and the Governor.

This is where the "imagined experts" step in and say: "It must have been a really magical bullet in order to enter Kennedy from the back, exit from his throat, then make a turn and enter Connally's back, exit from his chest, hit is right wrist, make another bend, and, finally, land in his left thigh!" How could a single bullet follow this zigzag route, seen in figure 1?

Their conclusion is obvious: those injuries could not have been produced by just one bullet, so there had to be more than one shooter—further proof of a conspiracy.

This conclusion, however, as logical as it may sound at first, does not take real facts into account. And it only works until you don't look at Kennedy's and Connally's actual positions in the car. They were not one in front of the other; Kennedy was in a higher position in the back seat, and Connally was sitting lower, in the middle of the front seat of the car. So, in order to produce those injuries, the path shown in figure 2 is the real trajectory that a bullet had to follow, and, from the analysis performed by real experts, it turns out that there was only one position from which this bullet could be shot: the sixth floor of the Texas School Book Depository.

What can we conclude from these examples? Certainly, that investigators must guard against preconceived ideas before starting an investigation. Before you know it, you start twisting facts and discarding evidence that contradict those ideas, making you draw unfounded solutions. What we should do instead is to try to do our best to dig up facts and let them speak for themselves. They may have things to say that often turn out to be quite surprising.

This article has been adapted from Massimo Polidoro's presentation at the fifth World Skeptics Congress (Abano Terme, Italy, October 8–10, 2004).

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Critical Thinking About Energy

The Case for Decentralized Generation of Electricity

Highly centralized generation of electrical power is a paradigm that has outlived its usefulness. Decentralized generation could save $5 trillion in capital investment, reduce power costs by 40 percent, reduce vulnerabilities, and cut greenhouse gas emissions in half.

THOMAS R. CASTEN and BRENNAN DOWNES

Electricity was originally generated at remote hydroelectric dams or by burning coal in the city centers, delivering electricity to nearby buildings and recycling the waste heat to make steam to heat the same buildings. Rural houses had no access to power. Over time, coal plants grew in size, facing pressure to locate far from population because of their pollution. Transmission wires carried the electricity many miles to users with a 10 to 15 percent loss, a difficult but tolerable situation. Because it is not practical to transmit waste heat over long distances, the heat was vented. There was no good technology available for clean, local generation, so the wasted heat was a tradeoff for cleaner air in the cities. Eventually a huge grid was developed and

the power industry built all-new generation in remote areas, far from users. All plants were specially designed and built on site, creating economies of scale. It cost less per unit of generation to build large plants than to build smaller plants. These conditions prevailed from 1910 through 1960, and everyone in the power industry and government came to assume that remote, central generation was optimal, that it would deliver power at the lowest cost versus other alternatives.

However, technology has improved and natural gas distribution now blankets the country. By 1970, mass-produced engines and turbines cost less per unit of capacity than large plants, and the emissions have been steadily reduced. These smaller engines and gas turbines are good neighbors, and can be located next to users in the middle of population centers. Furthermore, the previously wasted heat can be recycled from these decentralized generation plants to displace boiler fuel and essentially cut the fuel for electric generation in half, compared to remote or central generation of the same power.

But the industry had ossified. Electric monopolies were allowed to charge rates to give a fair return on capital employed. To prevent excessive or monopoly profits, the utilities have long been required to pass 100 percent of any gain in efficiency to the users. This leaves utilities with no financial incentive to adopt new technologies and build decentralized generation that recycles heat. In fact, such local generation erodes the rationale for continued monopoly protection—if one can make cheap power at every factory or high rise apartment house, why should society limit competition?

Congress tried to open competition a little bit in 1978, and some independent power companies began to develop on-site generation wherever they could find ways around the monopoly regulation. One author (Casten) was one of those early pioneers, working to develop more efficient decentralized generation since 1975. This article summarizes extensive research into the economically optimal way to build new power generation in each of the past 30 years, given then available technology, capital costs, and fuel prices, and concludes that the continuing near-universal acceptance of the "central generation paradigm" is wrong. The result is a skeptical look at the world's largest industry—the electric power industry—with surprising conclusions.

Power industry regulations largely derive from the unquestioned belief that central generation is optimal. However we believe the conventional "central generation paradigm" is based on last century's technology. Meeting the world's growing appetite for electric power with conventional central generation will severely tax capital markets, fossil fuel markets, and the global environment. The International Energy Agency's (IEA) 2002 World Energy Outlook Reference Case—based on present policies—presents a frightening view of the next thirty years.[1] The Reference Case says world energy demand will grow by two-thirds, with fossil fuels meeting 90 percent of the increase. World electrical demand doubles, requiring construction of nearly 5,000 gigawatts of new generating capacity, equivalent to adding six times current United States electric generating capacity. The generation alone will cost $4.2 trillion, plus transmission and distribution (T&D) costs of $6.6 trillion (2004 U.S. dollars). Under this projection, global carbon dioxide emissions increase by 70 percent; see figure 1.

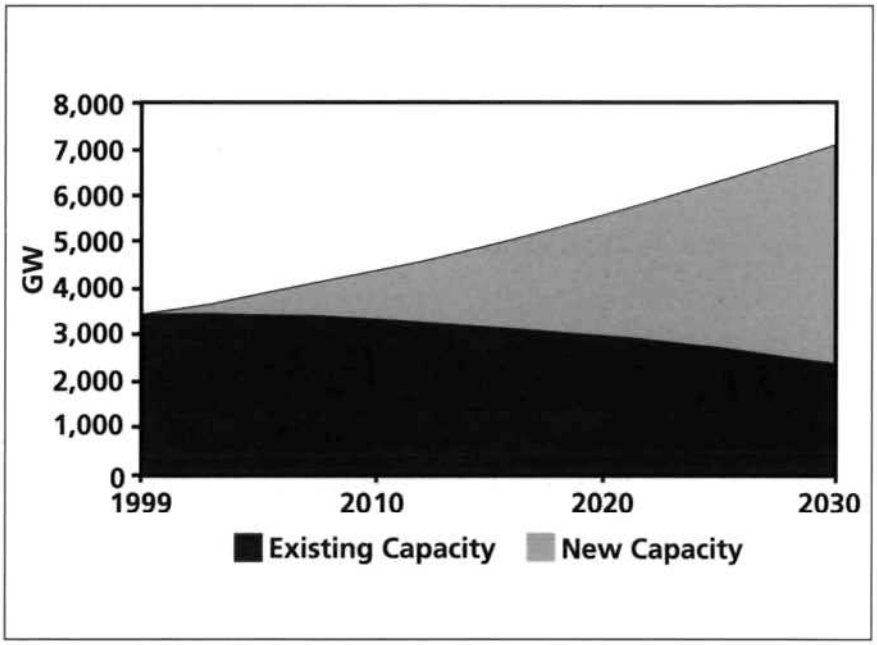

Figure 1. World installed electricity generation capacity.

The Reference Case assumes that the energy policies of each government in 2002 continue without change, a modest evolution of technology, and continued reliance on central generation of electric power, which is consistent with most existing policies and regulations. The IEA projections assume that central generation is the optimal approach, given today's technology.

The IEA report is silent on the need for (or capital cost of) new T&D, even though existing T&D is far from adequate. There were 105 reported grid failures in the U.S. between 2000 and 2003, and eleven of those outages affected more

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than a half million people.[2] U.S. consumers paid $272 billion for electricity in 2003,[3] plus power outage costs, estimated between $80 billion and $123 billion per year. Outages thus add 29 percent to 45 percent to the cost of U.S. power.[4] The T&D situation is worse in developing countries, where 1.6 billion people lack any access to electric power and many others are limited to a few hours of service per day. Satisfying expected load growth with central generation will clearly require at least comparable construction of T&D capacity.

Close examination of past power industry options and choices suggests that load growth can be met with just over half the fossil fuel and pollution associated with conventional central generation. *We had better get this world energy expansion right.* Consider these points:

- The power industry has not deployed optimal technology over the past thirty years.
- The universally accepted "Central Generation Paradigm" prevents optimal energy decisions.
- Decentralized generation (DG), using the same technologies used by remote central generation, significantly improves every key outcome from power generation.
- Meeting global load growth with decentralized energy can save $5 trillion of capital, lower the cost of incremental power by 35–40 percent, and reduce CO_2 emissions by 50 percent versus the IEA central generation dominated reference case.

A Brief History of Electric Generation

Figure 2 shows that United States net electric efficiency peaked in about 1910, when nearly all generation was located near users and recycled waste heat. That efficiency dropped to 33 percent over the next fifty years as the power industry moved to electric-only central generation. Industry efficiency has not improved in four decades. Technology improved, enabling conversion of fuel to electricity to rise from 7 percent at commercial inception to 33 percent by 1960. The best electric-only technology now converts more than 50 percent of the fuel to power, but the industry's average efficiency has not improved in forty-three years. No other industry wastes two-thirds of its raw material; no other industry has stagnant efficiency; no other industry gets less productivity per unit output in 2004 than it did in 1904.

Early generating technology converted 7 percent to 20 percent of the fuel to electricity, making electric-only production quite expensive. To reduce fuel costs, energy entrepreneurs, including Thomas Edison, built generating plants near thermal users and recycled waste heat, increasing net electric efficiency to as much as 75 percent. A second wave of technical progress after World War II drove electric-only efficiencies to 33 percent (after distribution losses) and increased individual plant size to between 500 and 1,000 megawatts. Central or remote generation of electricity only, while still wasting two-thirds of the input energy, became the standard. Buttressed by monopoly protection, utilities fought competing on-site generation and, by 1970, replaced all but 3 to 4 percent of local generation, ending waste heat recycling. Government regulations, developed over the first 90 years of commercial electricity, institutionalized central generation.

The third wave of technical progress should have reversed the central generation trend. Modern power plants emit only 1 to 2 percent as much nitrogen oxides as 1970 plants, come in all sizes, burn all fuels, and are good neighbors. Many technical advances make local or distributed generation technically and economically feasible and enable society to return to energy recycling, displacing boiler fuel and doubling net electric efficiency. However, protected from competition and rewarded by obsolete rules, the power industry continues to build remote plants and ignores opportunities to recycle energy.

The squares in figure 2 represent the alternative to central or remote generation. These are actual plants employing central plant generation technologies that are located near users. These combined heat and power (CHP) plants deploy the best modern electric-only technology and achieve 65 percent to 97 percent net electrical efficiency by recycling normally wasted heat and by avoiding transmission and distribution losses. United States Energy Information Agency (EIA) records show 931 distributed generation plants with 72,800 megawatts of capacity, about 8.1 percent of U.S. generation. These plants demonstrate the technical and economic feasibility of doubling U.S. electricity efficiency.

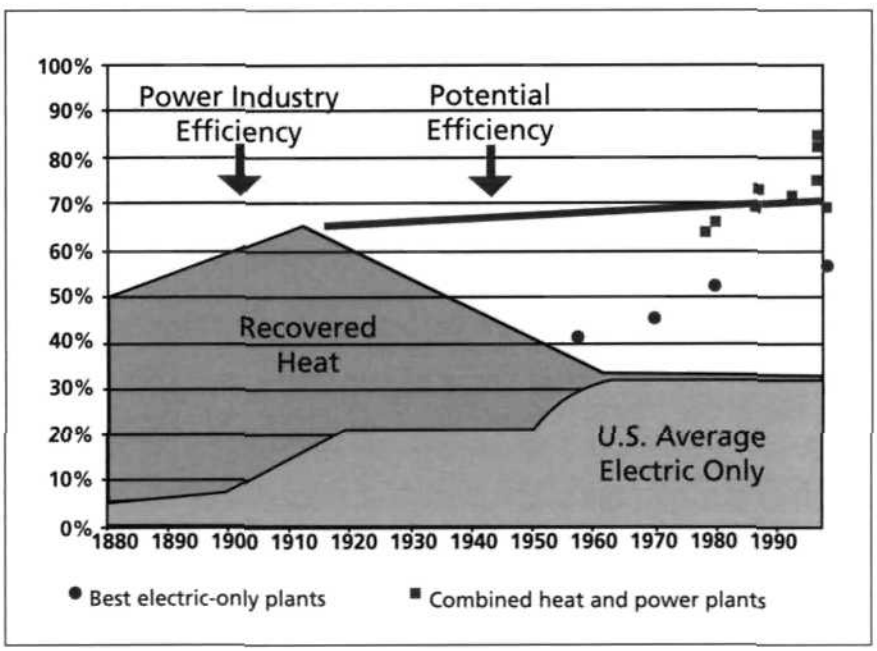

Figure 2. U.S. electricity generating efficiency, 1880 to present.

Nevertheless, the U.S. and world power industry ignores—and indeed actively fights against—distributed generation. Conventional central generation plants dump two-thirds of their energy into lakes, rivers, and cooling towers, while factories and commercial facilities burn more fuel to produce the heat just thrown away. We believe the power industry has not made wise or efficient choices, and set out to test this thesis with data.

A Flawed Worldwide Heat & Power System

To determine whether the power industry made optimal choices, we analyzed EIA data on all 5,242 reported generation plants, separating plants built by firms with monopoly-protected territories and plants built by independent power producers. We calculated what price per KWh would be required for each of four central generation technologies, built in each year, to provide a fair return on capital.[5]

We also analyzed distributed generation (DG) technology choices. Several clarifications are necessary:

- Distributed generation is any electric generating plant located next to users.
- DG is not a new concept. Edison built his first commercial electric plant near Wall Street in lower Manhattan, and he recycled energy to heat surrounding buildings.
- DG plants employ all of the technologies that are used in central generation.
- DG plant capacities range from a few kilowatts to several hundred megawatts, depending on the users' needs. We have installed 40-kilowatt back-pressure steam turbines in office buildings that recycle steam pressure drop, and managed a 200-megawatt coal-fired CHP plant serving Kodak's world headquarters in Rochester, New York.
- DG can use renewable energy, but not every renewable energy plant is DG. Solar photovoltaic panels on individual buildings or local windmills are distributed generation, while large hydro and wind farms are central generation requiring transmission and distribution (T&D).
- DG uses all fuels, including nuclear. Modern naval vessels generate power with nuclear reactors and then recycle waste heat to displace boiler fuel.

Power generated near users avoids the need for T&D. We have assumed each kilowatt of new DG will require net T&D investment equal to only 10 percent of a kilowatt, for backup services.[6] We assume DG plants require a 50 percent higher average cost of capital (12 percent versus 8 percent) due to risks and transaction costs. Industrial companies that install DG see power generation as a non-core activity and demand 35 percent to 50 percent rates of return, but this analysis focuses only on power companies' cost of capital.

Figure 3 depicts our findings. The light grey line shows the average price of power to all U.S. consumers in each year. The dashed lines show the retail price per megawatt-hour needed to fully fund new plants using four power generation technologies built as central stations, unable to recycle waste heat. (Note: Move the decimal one number left in price per megawatt-hour to equal cents per kilowatt-hour. For example, $65 per MWh is 6.5 cents per kWh.) The four highest solid lines show the retail prices per megawatt-hour needed to fully pay for power from the same technologies built near thermal users to recycle waste heat. The two lowest solid lines depict retail prices per MWh needed for power generated with recycled industrial process heat or flare gas, and power extracted from gas or steam pressure drop.

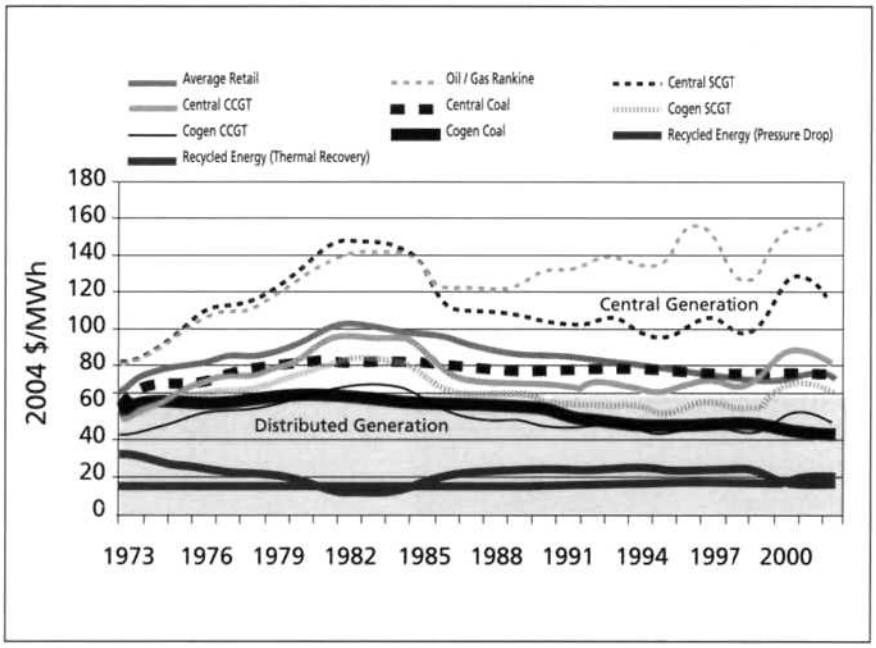

Figure 3. Long-term U.S. marginal cost of electric generation options.

Thermal plants generate steam by burning fossil fuel in boilers. The steam then drives condensing steam turbines. Thermal generation technology matured in the mid-fifties, achieving maximum electric-only efficiency of 38 percent to 40 percent, before line losses. Over the entire period, new central oil and gas thermal plants (top dashed line) required prices well above average retail. Gas turbines use a different cycle; the technology improved dramatically over the period. Simple cycle gas turbine plants (dashed line) required similar prices to gas-fired thermal plants until 1985–90, when improving turbine efficiency reduced fuel and lowered required prices. New coal plants (dashed black line) could sell power for below average retail prices each year until 1998. However, environmental rules blocked coal plants in many states.

Combined cycle gas turbine plants (CCGTs) are the same gas turbines described above, but the plants also make steam with the turbine exhaust to drive a second power generation cycle—a condensing steam turbine. The first commercial

applications of CCGTs were in 1974. These plants cost less to build than an oil and gas thermal plant and initially achieved 40 percent efficiency, which rose to 55 percent by 1995.

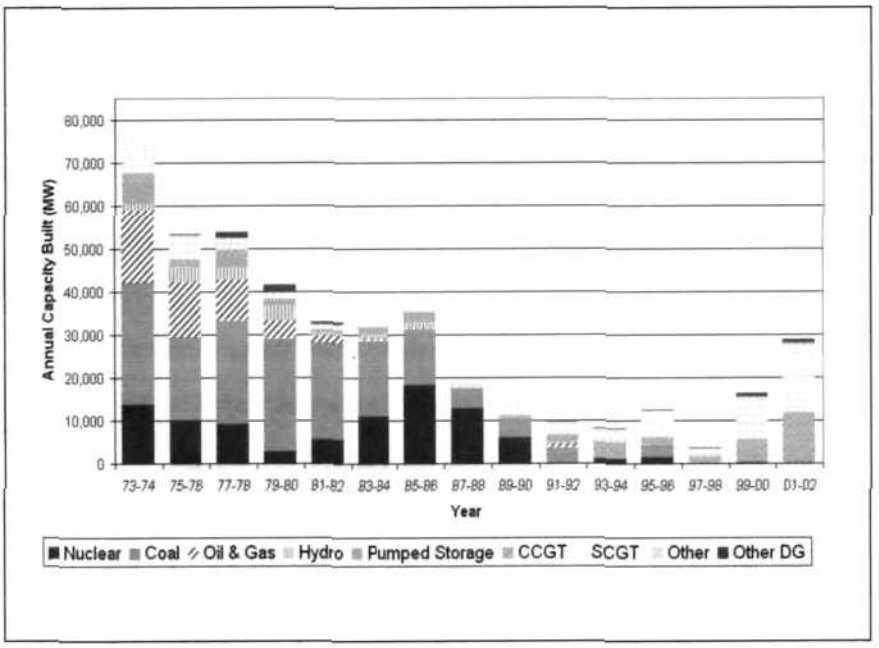

Figure 4. Annual U.S. utility additions of electricity generating capacity by technology, 1973–2002.

Distributed Generation Recycles Energy to Reduce Costs

The solid lines show retail prices required for distributed generation or DG—building the same technologies near thermal users and recycling normally wasted heat. The solid lines demonstrate the economic value of recycling energy. Burning coal in combined heat and power plants (solid black line) saves $11 to $27 per MWh versus burning coal in new central plants. Simple cycle gas turbine plants built near users (solid line) save $25 to $60 per MWh versus the same technology producing only electricity. Building combined cycle gas turbine plants near users and recycling waste heat saves even more money, reducing required costs by $25 per MWh versus the same technology built remote from users.

The lowest-cost power avoids burning any extra fossil fuel by recycling waste energy from process industries. Process industries use fossil fuel or electricity to transform raw materials and then discard energy in three forms including hot exhaust gas, flare gas, and pressure drop. Local "bottoming cycle" generation can recycle this waste into heat and/or power. The two lowest solid lines show the retail price per megawatt-hour needed for power recycled from waste heat, flare gas, and gas or steam pressure drop after credit for displacing boiler fuel with the recovered heat. These energy-recycling plants can earn fair returns on capital selling retail power at only 25 to 50 percent of average retail prices.

Power Industry Choices for New Capacity

An ideal approach would build all possible plants requiring the lowest retail price per megawatt-hour first and then build plants with the next lowest needed retail price, etc.

To determine whether the electric power industry made optimal choices, we analyzed all power plants built since 1973. The new generation built in each two-year period by monopolies, which we defined as any utility with a protected distribution territory, is seen in figure 4. Monopoly utilities include investor-owned utilities, cooperatives, municipal utilities, and state and federally owned utilities. They collectively built 435,000 megawatts of new generation, but ignored energy recycling, even though it was always the cheapest option. They continued to build oil and gas thermal plants long after CCGT plants were a cheaper central option. Monopoly utilities were slow to make optimal choices among central plant technologies and completely ignored the more cost-effective distributed use of the same technologies.

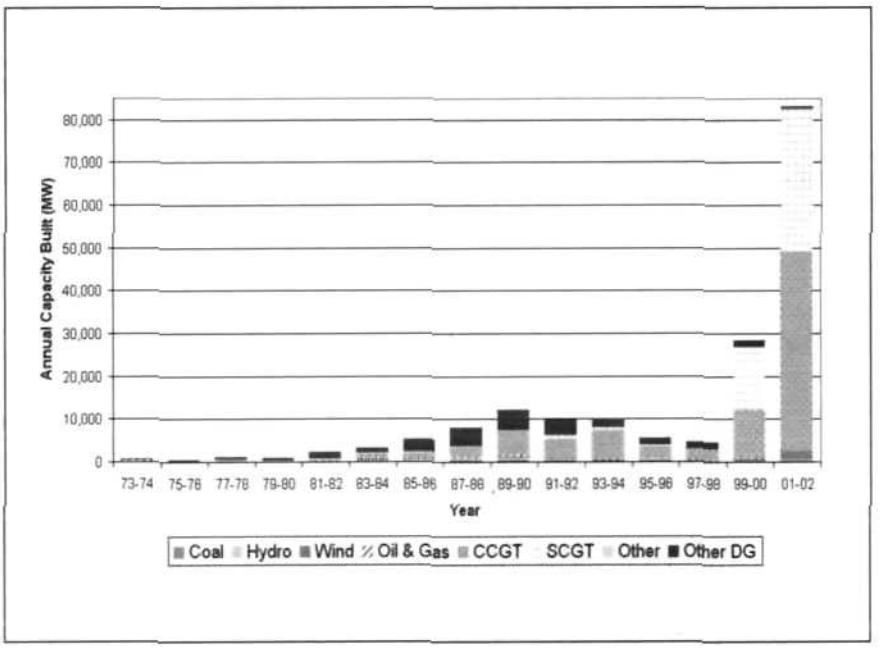

Figure 5. Total U.S. independent power producers utility additions of electric generating capacity by technology, 1973–2002.

Figure 5 shows the 175,000 MW of new generation built by independent power producers (IPP's) since 1973. Most new

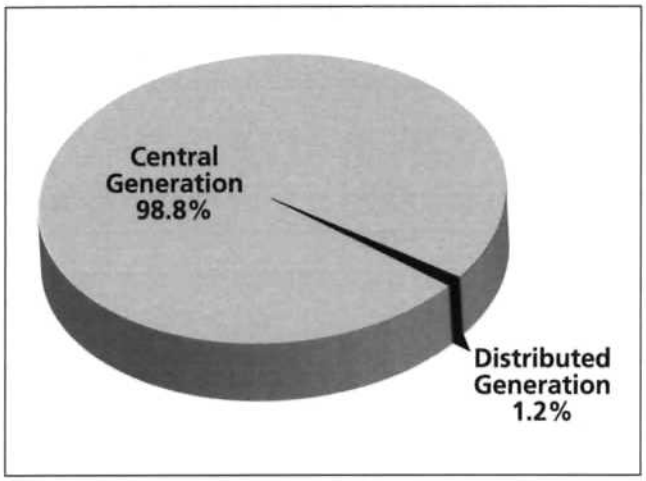

Figure 6. Total generation capacity built by U.S. electric utilities, 1973–2002.

IPP plants were distributed generation and/or combined cycle plants until the last four years. The price spikes of 1998–2000 apparently induced IPP companies to install simple cycle gas turbines for peaking. Prior to 1978 passage of the Public Utility Policy Regulatory Policy Act (PURPA) it was illegal to build generation as a third party. Between 1978 and the law change in 1992, IPPs were allowed to build qualifying facilities—those that recycled at least 10 percent of the fuel's energy for heat use, or utilized certain waste fuels. After 1992, IPPs could legally build remote electric-only generation plants.

For another view of industry choices, we divided plants built since 1973 into those recycling and not recycling energy. Generating plants that recycle energy must be near thermal users or near sources of industrial waste energy. Figure 6 shows that only 1.2 percent or 5,000 of the 435,000 megawatts of new generation built by monopolies over the thirty-year period recycled energy. We doubt that these choices would be profitable in a competitive marketplace.

Independent power producers built 34 percent of their total capacity as DG plants, at or near users. Figure 7 depicts the mix of central and distributed power built by IPPs since 1978.

Finally, we estimated the potential generation from the least-cost options—those plants that recycle industrial process waste energy. EPA aerometric data and other industry analyses suggest that U.S. industrial waste energy would power 40,000 to 100,000 megawatts with no incremental fossil fuel and no incremental pollution.[7] However, EIA plant data show only 2,200 megawatts of recycled industrial energy capacity, 2.2 percent to 5 percent of the potential.[8]

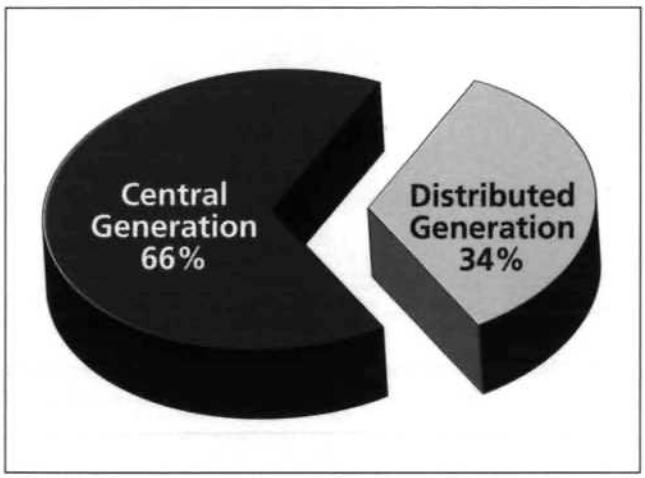

Figure 7. Generation capacity built by U.S. electric IPPs, 1973–2002.

It seems clear that the power industry has made poor choices that have increased cost and decreased efficiency. These data show that utilities eschewed least-cost generating technologies, effectively increasing prices to all customers.

Meeting Expected U.S. Load Growth with Local Generation

Our colleagues built a model to determine the best way to satisfy projected load growth for any nation over the next two decades.[9] The model incorporates relevant factors for central and distributed electric generation technologies, including projected improvements in cost, efficiency, and availability of each technology. The model assumes new central generation will require 100 percent new transmission and distribution and new decentralized generation will require new T&D equal to 10 percent of added generating capacity. The model assumes 9 percent line losses for central power, equal to U.S. losses for 2002, and 2 percent net line losses for DG power.

Although the future surely includes some mix of central and decentralized generation, the model calculates the extreme cases of meeting all load growth with central generation, or meeting all growth with decentralized generation. Local generation that recycles energy improves every important outcome versus full reliance on central generation. Figure 8 compares the extreme cases. Full reliance on DG for expected U.S. load growth would avoid $326 billion in capital by 2020, reduce incremental power costs by $53 billion, NO_x by 58 percent, and SO_2 by 94 percent. Full DG lowers carbon dioxide emissions by 49 percent versus total reliance on new central generation.

Impact of Generating 2020 Load Growth with Central or Decentralized Generation

	100 percent CG	100 percent DG	Savings	Percent Change
Total Capital Cost (Capacity + T&D) Billions of Dollars	$831	$504	$326	39 percent
2020 Incremental Power Cost Billions of Dollars	$145	$92	$53	6 percent
2020 Incremental Power Cost Cents/KWh	8.61	5.47	3.14	36 percent
Emissions from New Load Thousand Metric Tonnes				
NO_x	288	122	166	58 percent
SO_2	333	19	314	94 percent
PM10	22	12	9	43 percent
Million Metric Tonnes CO_2	776	394	381	49 percent

Figure 8. Decentralized generation as a percentage of total U.S. generation.

Extrapolating U.S. Analysis to the World

We lack the data to run the U.S. model for the world, but have taken the percentage savings to be directionally correct and applied them to the IEA load growth projections through 2030. Detailed analysis by others will undoubtedly refine the estimates, and there will be some mix of central and decentralized generation. The analysis shows the *extreme cases to provide guidance.*

Figure 9 shows expected world load growth with conventional central plants that convert 100 units of fuel into 67 units of wasted energy and 33 units of delivered power. The text at the bottom reflects IEA's projected capital cost for 4,800 gigawatts of new generation, totaling $4.2 trillion. The International Energy Agency was silent on T&D, so we used estimates made for the United States Department of Energy on the all-in cost per kW of new transmission to forecast $6.6 trillion cost for new wires and transformers. Assuming U.S. average line losses (which are significantly lower than developing country line losses), 9 percent of the capacity will be lost, leaving 4,368 gigawatts delivered to users. To achieve the IEA Reference Case with central generation, the world must invest $10.8 trillion capital, roughly $2,500 per kW of delivered capacity.

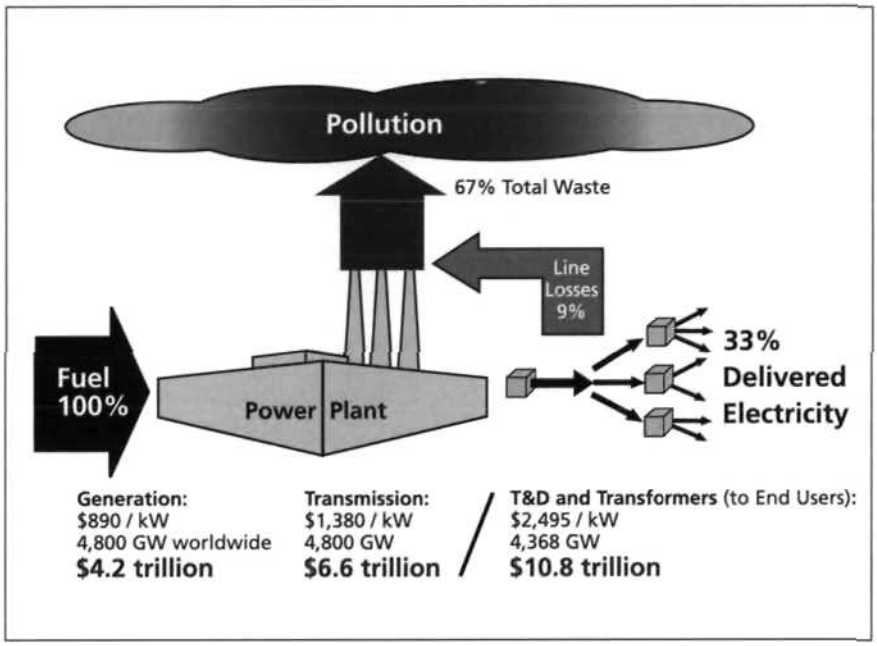

Figure 9. Conventional central generation flowchart.

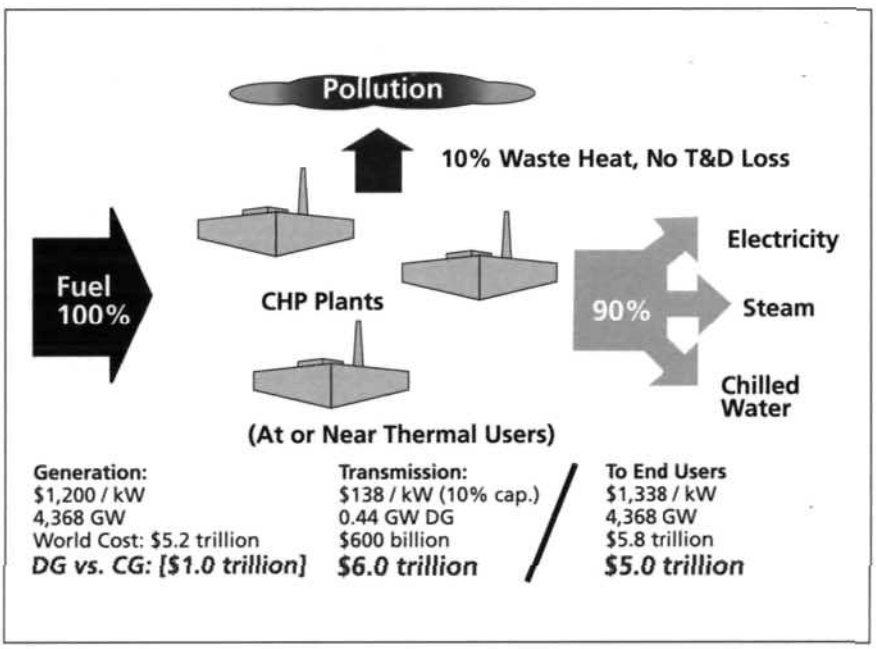

Figure 10. Combined heat and power flowchart.

Meeting IEA Reference Case load growth with decentralized generation will lower the need for redundant generation. An analysis by the Carnegie Mellon Electric Industry Center suggests building only 78 percent of the 4,800 gigawatts as DG would provide equal or better reliability.[10] However, in developing economies, reliability may not be the driver. To be conservative, we have ignored the potential reduction in generation due to increased reliability inherent in larger numbers of smaller plants in the DG case. However, we did reduce required generation for the DG case to 4,368 GW, since there are no net line losses.

Figure 10 depicts the process of meeting expected world load growth with distributed generation. We estimated average capital costs for decentralized generation of $1,200 per kW, $310 more capital cost than a kilowatt of new central generation. Even with 9 percent less DG capacity, the capital costs for generation increase to $5.2 trillion, $1.0 trillion more than building central plants. Looking only at generation costs, DG is not competitive. However, the full decentralized generation case requires only 430 GW of new T&D, costing $0.6 trillion, a $6 trillion savings on T&D. *End users receive 4,638 GW in both cases, but society invests $5 trillion less for the DG case.*

Everyone knows that "you get what you pay for." What does the world give up by selecting a $5 trillion cheaper approach to meet projected electric growth? We extrapolated U.S. analysis to the IEA Reference Case and found the world would give up the following by adopting the cheaper DG case:

- Consume 122 billion fewer barrels of oil equivalent (half of known Saudi oil reserves)

- Lost fossil fuel sales of $2.8 trillion
- Lost medical revenues from air pollution-related illnesses
- Potentially lost savings if governments opt to supply electric services to entire population instead of leaving 1.4 billion people without electric access
- Less global warming due to 50 percent less CO_2 emissions.

Recommended Actions

If this analysis survives critical review, then what policy reforms will steer the power industry toward optimal decisions, given available technology? We offer two potential approaches, hoping to start the policy debate.

Distributed generation of electricity saves the world $5 trillion in capital investment while reducing power costs by 40 percent and cutting greenhouse gas emissions in half. There are important implications for worldwide energy policy if this analysis is correct.

Comprehensive Reform

Governments guide the electric industry with many rules, mandates, and limitations that collectively block competition and innovation, thus causing excessive costs and fuel usage. Small regulatory changes may nudge the power industry to slight course corrections, but are unlikely to break the central generation paradigm and optimize generation.

Immediately eliminating all current barriers to efficiency would cause the electric power industry to make better decisions. Each government could examine every rule that affects power generation and delivery and ask whether the social purpose behind that rule still exists. Then each state or country could enact comprehensive legislation that we term the Energy Regulatory Reform and Tax Act (ERRATA), to correct all of the mistakes in current law. ERRATA would deregulate all electric generation and sales, modernize environmental regulations to induce efficiency, and change taxation to reward efficiency.[11] Sadly, ERRATA legislation probably will not pass except in response to deepening environmental and economic pain.

Actionable Reform, National Fossil Fuel Efficiency Standards

A second possible approach simply rewards all fossil efficient power and penalizes fossil inefficient power. Each government could enact a Fossil Fuel Efficiency Standard covering all locally used electricity, regardless of origin. This standard does not favor fuels, technologies, or participants. Here are the essential elements:

- Give all delivered megawatt-hours an equal allowance of incremental fossil fuel, regardless of age of plant, technology or ownership. Start with the national average fossil fuel per MWh for the prior year.
- Spread allowances over all generation of each owner, allowing owners to comply by increasing efficiency of existing plants, deploying new highly efficient plants, or purchasing fossil allowances from others.
    - Reward plants requiring little or no fossil fuel, such as solar, wind, hydro, nuclear, and industrial waste energy recycling, by allowing them to sell fossil fuel credits.[12]
    - Penalize fossil inefficient plants by forcing them to purchase allowances for each MWh produced.
    - Base allowances on delivered power to incorporate T&D losses from central generation.
    - Credit displaced fuel to CHP plants that recycle heat.
    - Force all generators to purchase adequate allowances or close their plants to ensure that the total allowance trading is economically neutral.
    - Reduce the fossil fuel allowances per MWh each year according to a schedule.
- Adjust the schedule downward each year to correct for growth in total power delivered, guaranteeing that the total fossil fuel use will drop.

A Fossil Fuel Efficiency Standard would steer the power industry toward optimal choices. This will reduce power costs and emissions, which will improve local standard of living and improve the competitive position of local industry. Other states and nations will follow suit.

Conclusion

We have attempted to frame the consequences of meeting energy load growth with conventional central generation or deploying decentralized generation that recycles waste energy. The DG case saves the world $5 trillion in capital investment while reducing power costs by 40 percent and cutting greenhouse gas emissions in half. There are interesting implications for worldwide energy policy if this analysis stands up to critical review.

We hope readers and others will spell out concerns or suggest corrections so we can collectively improve the analysis of optimal future power generation. The needed policy changes are deep and fundamental and require a consensus about the best way to proceed. Together we might be able to change the way the world makes heat and power.

Notes

1. The IEA has issued an annual "World Energy Outlook" series since 1993. The publication projects many facets of the energy industry thirty years ahead. The projections are based on a "Reference Scenario that takes into account only those government policies and measures that had been adopted by mid-2002. A separate Alternative Scenario assesses the impact of a range of new energy and environmental policies that the OECD countries are considering."

2. *Energy Information Administration/Electric Power Monthly*, May 2004.

3. *Energy Information Administration/Monthly Energy Review*, June 2004.

4. Joseph Eto, of the Lawrence Berkeley National Laboratory, in a speech to NARUC, says outages cost the U.S. $80 billion per year. The EPRI Consortium for Electric Infrastructure to Support a Digital Society (CEIDS), *The Cost of Power Disturbances to Industrial & Digital Economy Companies*, June 2001, states power outages and other power quality disturbances are costing the U.S. economy more than $119 annually.

5. We assembled historical data for four central generating technologies—oil and gas-fired thermal plants (Rankine cycle), coal fired thermal plants, simple-cycle and combined-cycle gas turbines. Data for each technology and each year include capital costs per kW, load factor, and efficiency. We assumed a 25-year life to calculate annual capital amortization and the future wholesale price per MWh that would yield an 8 percent weighted average return on capital. Since new central generation requires new T&D, we converted estimates of $1260 per kW for T&D in 2000 and adjusted for inflation, then assumed a 35-year life for T&D to calculate required T&D charges. EIA did not keep line loss statistics prior to 1989, so we estimated prior years slightly below the current 9 percent losses. Summing produces the retail price needed for power from a central plant using a specific technology installed in that specific year. Finally, we converted everything to 2004 dollars.

6. Typical DG plants employ multiple generators with expected unplanned outages of 2 percent to 3 percent each. The probability of complete loss of power is found by multiplying expected unit unplanned outages by each other. Given the existing 10,286 generators operating in the U.S. that are less than 20 megawatts of capacity, and the expectation, with barriers removed, of many DG plants inside every distribution network, spare grid capacity equal to 10 percent of installed DG should be more than adequate to cover unplanned outages.

7. *Recycled Energy: An Untapped Resource*, Casten and Collins, 2002; see www.primaryenergy.com.

8. Energy Information Administration, *Annual Energy Review 2002*, October 2003.

9. The "Optimizing Heat and Power" model has been adopted by the World Alliance for Decentralized Energy (WADE) and is being used by the European Union, Thailand, Nigeria, Canada, Ireland, and China to ask the best way to satisfy expected load growth. For model descriptions, contact Michael Brown, Director, at info@localpower.org.

10. Hisham Zerriffi. Personal communication. See *Distributed Resources and Micro-grids* by M. Granger Morgan of the Department of Engineering and Public Policy, Carnegie Mellon University, Sept. 25, 2003, for detailed analysis of how DG provides reliability with less spare capacity.

11. See Casten, Thomas R. *Turning Off The Heat* 1998, Prometheus Books, chapter 10 for a more complete description of ERRATA.

12. Producers of electricity are given fossil fuel usage credits, meaning they are allowed to use a given amount of fossil fuels corresponding to efficiency, size of unit and other environmental parameters. Thus, the higher the efficiency of a company's unit, the less fossil fuel credits that company needs to use. The highly efficient plants and generation plants using a non-fossil fuel energy such as solar, wind, or hydro power would not need the full allowance and could sell the unused portion to less efficient fossil fueled plants. Such a system would provide added economic value to the efficient and non-fossil fueled plants and economic penalties to the inefficient fossil fueled plants. □

Glossary of Abbreviations and Acronyms

CCGT—Combined-cycle gas turbine—refers to a power plant that utilizes both the Brayton (gas-turbine) cycle and the Rankine (steam) cycle. The exhaust from the gas turbine is used to generate the energy for the Rankine cycle.

CHP—Combined heat and power—the simultaneous and high-efficiency production of heat and electrical power in a single process.

CO_2—Carbon dioxide—a gas produced by many organic processes, including human respiration and the decay or combustion of animal and vegetable matter.

DG—Decentralized/distributed generation—a system in which electrical power is produced and distributed locally near users, largely avoiding T&D.

DOE—Department of Energy—the federal agency that oversees the production and distribution of electricity and other forms of energy.

EIA—Energy Information Administration—the statistical and data-gathering arm of the Department of Energy.

EPA—Environmental Protection Agency—the agency that oversees and regulates the impact of, among other things, the production of energy on the environment of the United States.

ERRATA—Energy Regulatory Reform and Tax Act—a plan to deregulate the production and distribution of electricity, to update environmental laws regarding energy production, and to alter the existing tax structures.

GW—Gigawatt—one billion watts.

GWh—Gigawatt hour—the amount of energy available from one gigawatt in one hour.

IEA—International Energy Agency—a twenty-six member union of national governments with the goal of securing global power supplies.

IPP—Independent power producers—companies that generate electrical power and provide it wholesale to the power market. IPPs own and operate their stations as non-utilities and do not own the transmission lines.

KW—Kilowatt—1,000 watts (one watt being the amount of power necessary to move one kilogram one meter in one second).

KWh—Kilowatt hour—the amount of energy available from one kilowatt in one hour.

MW—Megawatt—one million watts.

MWh—Megawatt hour—the amount of energy available from one megawatt in one hour.

NO_x—Nitrogen oxide—assorted oxides of nitrogen, generally considered pollutants, that are commonly produced by combustion reactions.

PM10—Particulate matter in the atmosphere that is between 2.5 and 10 micrometers in size.

PURPA—Public Utility Regulatory Policy Act—an act of Congress that was intended to reduce American dependence on foreign oil through the encouragement of the development of alternative energy sources and the diversification of the power industry.

T&D—Transmission and distribution—the means by which electricity travels from the generating plant(s) to its end users.

Exploring Controversies in the Art and Science of Polygraph Testing

Polygraph testing has always been controversial, with a wide gulf separating practitioners from scientists with relevant expertise. Myths about its alleged objectivity and infallibility stem from a failure to recognize that the polygraph simply records physiological responses and that the validity with which deception can be diagnosed depends on the nature of the examination and its social context.

JOHN RUSCIO

Polygraph or "lie detector" tests have been conducted extensively in the United States since the early twentieth century, with comparatively little popularity elsewhere. The technique has been used to aid in criminal investigations, civil disputes, and the screening of job applicants and current employees. Polygraph testing has been controversial since its inception, with a substantial gulf separating practitioners from scientists with expertise in psychophysiology, measurement, decision making, and related disciplines. Aside from a trend toward computerized recording and scoring of polygraph charts, there has been little fundamental change in the technology or its implementation in the past fifty years, and a number of widespread myths persist despite

the lack of noteworthy advances in the field. Among the lay public, the press, and policy makers, confusion about the alleged objectivity and infallibility of polygraph testing often stems from a failure to recognize that the polygraph is simply a device to record physiological responses and that the validity with which deception can be diagnosed from such responses depends on the nature of the examination that is performed and its social context. My goal in this article is to dispel some of these myths by describing the different types and uses of polygraph tests, as well as empirical findings and additional considerations bearing on the validity and utility of those tests.

Two Pervasive Myths of Polygraph Testing

Many people perceive polygraph testing to be an *objective* way to distinguish honesty from deception, a scientific practice that is carried out in an impartial manner. The gadgetry of the standard polygraph device—which measures electrodermal, cardiovascular, and respiratory responses—may be responsible for this scientific mystique, yet with the exception of one type of application, polygraph testing has been developed and promoted primarily by nonscientists (Lykken 1998). A polygraph examination involves a lengthy pretest interview during which the examiner gains access to a wealth of background information and formulates specific questions that are then used during the test phase, when physiological responses are recorded. The type of questions that are constructed and the interpersonal manner with which they are posed can have a significant influence on the examinee's physiological responses. Moreover, the scoring and interpretation of the polygraph chart also require subjective judgments that can be influenced by an examiner's preconceptions, and there remains a critical need for well-validated computerized scoring and interpretive systems.

An exposé on private polygraph firms aired by *60 Minutes* in 1986 underscores the subjectivity of the process and its susceptibility to confirmation bias due to the contamination of an examiner's diagnosis with information obtained outside of the formal polygraph test. As summarized by Ben-Shakhar (1991, 236):

> Three different polygraph firms were independently called to test an alleged theft of a camera and lens from a photography magazine office employing four employees. In fact, nothing was stolen from the office, but the polygraph examiners were told that it could only have been done by one of the four employees. Each polygraph examiner was told that "it might have been ____," with a different employee being fingered in each case (a decidedly weak fingering). In each case, the polygraph examiner identified the "fingered" employee as deceptive, and cleared the other "suspects." Moreover, all polygraph examiners expressed complete confidence in their decisions. This demonstrates not only that polygraph examiners can go wrong, but that their judgment and decision-making processes are infected by a systematic and powerful source of bias, a bias caused by contamination.

In addition to potential biases in the administration and interpretation of a polygraph test, it is important to note that there are no unique physiological indices of deception (Lykken 1998; National Research Council [NRC] 2003). A number of psychological states influence the processes measured by the polygraph. For example, even innocent suspects may be alarmed or aroused by questions that imply wrongdoing, and the fact that examinees recognize that they may be fined, fired, imprisoned, or otherwise sanctioned based on their responses to key questions can often cause them to exhibit many of the behavioral and physiological reactions often believed to be uniquely indicative of deception. In its review of the polygraph literature, the NRC (2003) faulted proponents for failing to establish a plausible theoretical base linking polygraph responses to deception or to draw from relevant basic science research to measure those physiological processes that are likely to yield the greatest validity. For example, certain measures of brain activity show considerable promise as physiological responses that are less susceptible to countermeasures because of their rapidity and automaticity, yet there is little ongoing research to suggest a serious interest in improving polygraph technology (NRC 2003).

A second myth involves alleged infallibility of polygraph testing, the notion that the technique can be used to distinguish honesty from deception without error. Proponents derive much of their confidence from understandable but seriously flawed inferences. For example, Lykken (1998) cites a statement made by one polygrapher who testified before the Minnesota legislature in 1975 that he'd given more than 20,000 polygraph tests and had "never been shown to have made a mistake" (69). Because polygraph tests are ordinarily administered when other evidence is weak, one may never know with reasonable

certainty whether the examinee was in fact guilty of the alleged misconduct; that is, "ground truth" remains unknown. To the extent that polygraph results are taken to be definitive, further investigation is seldom undertaken to determine the validity of the inferences drawn from polygraph tests.

Another flawed source of intuitively compelling support stems from the fact that many examinees make confessions or offer damning admissions after an examiner suggests that their responses were deceptive. Such confessions are insufficient to establish the validity, much less the infallibility, of the polygraph test itself for at least two reasons. First, many confessions themselves are false statements, perhaps offered in an attempt to mitigate the consequences of having failed the polygraph test. In some instances, examinees' own faith in the infallibility of the polygraph has caused them to doubt the accuracy of their own memory, supposing that they must be guilty of the alleged offense even if they cannot recall it (Lykken 1998).

A second problem with using confessions as the criterion against which to evaluate the validity of polygraph testing is that this introduces a substantial bias. A study by Murray (1989) nicely illustrates this flawed logic. Of the 552 actual criminal suspects given polygraph tests, 239 (43%) were diagnosed as deceptive and were pressed for confessions; 104 (44%) of these individuals confessed, and 3 other individuals were later cleared by the confessions of other suspects. The 313 suspects diagnosed as nondeceptive were not pressed for confessions, but 18 (6%) of them were cleared by subsequent confessions of others. Noting that only 3 errors had been documented (the individuals diagnosed deceptive who were later cleared by others' confessions), Murray reported an accuracy of 99.4% for the polygraph. This conclusion is entirely unwarranted, as it presumes that the remaining 132 individuals diagnosed deceptive who did not confess were in fact guilty *and* that the remaining 295 individuals diagnosed honest who did not confess were in fact innocent, yet there was no independent corroboration of *any* individual's guilt or innocence. To see just how illogical Murray's conclusion is, consider the fact that equal (or perhaps even superior) results may have been obtained by tossing a coin to diagnose deception rather than actually scoring and interpreting the polygraph charts. Roughly half of all suspects would be diagnosed deceptive by the coin toss, and a substantial proportion would no doubt have confessed (keeping in mind that the base rate of guilt in this sample was quite high). Likewise, among the half of all suspects diagnosed honest by the coin toss, some would later be cleared by the confessions of others.

The proper way to calculate the empirical accuracy of polygraph testing is to establish ground truth with reasonable certainty and tally the results for tests administered to *all* examinees, not simply the subsample whose confessions support the initial diagnosis of deception (even if purely by chance). Likewise, it is essential that those who score and interpret the polygraph charts remain blind to outside information relevant to the case. Otherwise, there is no way to determine whether examiners are making diagnoses on the basis of case facts available without the polygraph test or on the basis of the polygraph chart itself.[1] To date, no field study has been conducted that meets even these minimal standards of scientific objectivity.

So just how accurate are polygraph tests? In light of the present evidence, it is extremely difficult to reach a defensible judgment and virtually impossible to summarize the results with a single numerical estimate. The National Research Council (2003) conducted a thorough review of the empirical literature on polygraph testing. Although they found the internal and external validity of the studies performed to date to be generally quite weak, especially for field studies, they concluded that polygraph testing can achieve results significantly better than chance, but far from perfect. Thus, despite decades of widespread use and ample opportunity to conduct informative laboratory and field studies, the quality of polygraph research remains low and claims of infallibility or near infallibility remain unsupported.

Uses and Types of Polygraph Tests

Broadly speaking, polygraph tests are used for two primary purposes: in investigating specific incidents (e.g., crimes, security violations) and for screening (e.g., evaluating the honesty of prospective or current employees). Although there are subtle variations, two primary types of polygraph tests are used: the control question test (CQT; Raskin and Honts 2002) and the guilty knowledge test (GKT; Lykken 1959; Nakayama 2002; also known as the "concealed information test"). I will explore in turn the use of each type of test for each purpose.

Specific Incidents

When an examinee is suspected of having engaged in a particular act of misconduct, polygraph testing can be performed using either type of test. For a CQT, the examiner constructs a series of questions that includes items relevant to the specific incident (e.g., "Did you steal $2,000 from your employer?") and items intended to serve as a point of comparison (e.g., "Since the age of eighteen, have you ever lied to get out of trouble?"). The latter questions are designed to be psychologically arousing to most examinees, with the presumption that anyone would need to lie (rather than overtly admit to past dishonesty, which would be perceived as incriminating in its own right) because of the ubiquity of at least minor acts of dishonesty in everyone's past. Such items are often referred to as "control" questions, although they do not provide reasonable controls in the scientific sense of the term.

The rationale underlying the interpretation of a CQT is that guilty individuals will be more aroused by the relevant than the control items, whereas innocent individuals will be more aroused by the control than the relevant items. Unfortunately, the presumed directionality of these responses reflects a naïve understanding of psychology. Because the relevant and control questions are discussed and agreed upon by the examiner and

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examinee during the pretest interview, they are easily distinguished during the test phase. This has two consequences, both of which tend to undermine the validity of the CQT. First, both innocent and guilty suspects recognize which questions are important for their futures, and are likely to feel considerably more threatened by the relevant questions. Not surprisingly, many studies of the CQT reveal an alarmingly high rate of false-positive diagnoses of deception: It is not uncommon for 40 percent to 50 percent of innocent suspects to fail a CQT polygraph examination (Lykken 1998; NRC 2003). Second, whether innocent or guilty, savvy examinees can take advantage of any number of countermeasures to systematically increase their physiological responses to the control questions, thereby passing the test. Lykken notes that laboratory studies have shown that college students can be trained to beat this type of polygraph test in under an hour. One can only suppose that individuals facing serious consequences on the basis of real-life polygraph tests would be especially motivated to learn and practice countermeasures prior to their examinations.

Whereas the CQT is based on several implausible assumptions (Lykken 1998) and nonetheless predominates in practice, the GKT has been developed by scientists and holds much greater promise for the investigation of specific incidents. Rather than attempting to determine the truthfulness of an examinee's responses to relevant items, this technique aims to assess whether an examinee possesses knowledge to which only a guilty individual would have access. To do so, a series of multiple-choice questions is constructed such that one choice is correct and the others are equally plausible to an innocent suspect. For example, one item relevant to a murder investigation could include a number of potential murder weapons, another could include descriptions of the victim's clothing at the time of the attack, and so forth. A total of six choices are usually provided for each question, with the correct alternative positioned randomly among the latter five choices (due to primacy effects, the first choice is not scored). The examinee is asked to repeat each of these choices out loud, which may serve to thwart potential countermeasures based on self-induced competing thoughts, and a score is calculated based on the frequency with which the maximal physiological response coincides with the correct alternative. An examinee who consistently responds most strongly to the correct choices is judged to possess knowledge of the incriminating information, whereas an examinee who responds to the correct choices at chance levels is judged not to possess this knowledge.

The larger the number of good items, the more accurately one can draw conclusions from a GKT. A *good item* is one for which the correct choice is salient to a guilty individual, but all choices are equally plausible to innocent individuals. One can pilot-test candidate GKT items on known-innocent examinees to evaluate the latter criterion, but the former may be more difficult to establish. The guilty individual must have noticed the relevant stimulus at the time of the incident and remember it during the polygraph test. To the extent that a large number of good items can be constructed, a GKT can differentiate those who do and do not possess the incriminating information with impressive accuracy (Beh-Shakhar and Elaad 2003). In stark contrast to the CQT, it is noteworthy that the GKT provides excellent protection for innocent suspects because the rate of false-positive identifications can be minimized by using a large number of items and setting a stringent threshold for diagnosing the possession of guilty knowledge. Field studies of the GKT are badly needed, but for reasons I'll discuss shortly law enforcement agencies have been uncooperative with scientists who wish to perform such studies.

The rationale underlying the GKT is based on the well-established nature of an "orienting response." This is similar to the so-called "cocktail party effect" whereby one's attention is automatically drawn to familiar information, such as hearing your own name spoken at a crowded cocktail party. It is especially difficult to suppress such a response to familiarity, and it would be difficult to systematically increase one's physiological response to all of the incorrect alternatives. To do so would require a large number of self-induced increases and decreases in arousal. This would be difficult to effect repeatedly and would lead to two additional problems. First, employing countermeasures a great many times may tip off a skilled examiner, thereby signaling the intention to deceive. Second, it may be possible to detect statistical differences in physiological responding if the *smallest* response consistently coincides with the correct alternative or if far *fewer* maximal responses coincide with the correct alternatives than would be expected by chance. In other words, the successful use of countermeasures requires that one establish a genuinely chance-level pattern of responding, which would be exceedingly difficult.

Although detractors have argued that the GKT may be applicable to only a small proportion of specific incident investigations, this remains an open question. For example, if police investigators began collecting information specifically for the construction of a GKT as soon as they arrived on the scene of a crime, and if they successfully withhold information from the news media (details incidental to the story, yet salient to the perpetrator, could feasibly be kept secret), it may be possible to use the GKT quite often. In fact, the technique is being used regularly in Japan (Nakayama 2002). It appears that the primary obstacle to implementing the GKT in the United States is that police officers and the polygraphers they employ are too convinced of the validity of the CQT. Another potential problem: Whereas the CQT was developed and has been promoted by the law enforcement agencies, the GKT was developed and is widely endorsed by psychological scientists. Thus, an unfortunate turf battle may contribute to the reluctance to perform field studies of the GKT in the U.S.—scientists need the cooperation of the police to conduct such research. Finally, a large-scale switch from the CQT to the GKT may represent an admission that law enforcement agencies have long been using a flawed technique, and this may also call into question convictions that were based in part on polygraph evidence.

Screening

Polygraph testing is also used to screen prospective or current employees. Under certain circumstances, it may be possible to use the GKT to screen employees suspected of committing a particular misdeed. In such "focused screening" applications, polygraph testing could proceed as it does in the context of

specific incident investigations. In the majority of screening applications, however, no particular transgression is suspected.

Pre-employment screening and either regular (e.g., every five years) or aperiodic (i.e., random time intervals) employee screening is performed to assess the honesty of employees without reference to any alleged or suspected specific incident in order to predict the likelihood that an examinee will perform acceptably on the job. Given the substantial problems of employee theft, sabotage, security violations, or other costly or dangerous misdeeds, past misconduct or dishonesty may suggest a risky hire or the need to terminate an employee. Because no specific incident is involved in these types of screening, the GKT cannot be used, and tests analogous to the CQT must be constructed. Physiological responses to questions pertaining to a number of different areas—such as general honesty or past misconduct such as theft or drug use—serve as points of comparison for one another. The use of more general questions likely decreases the magnitude of any differences in responding, and such differences are interpretationally ambiguous in any event because questions about some topics may be inherently more threatening or arousing to particular examinees for any number of reasons. Both of these problems are likely to substantially weaken the validity of such screening tests (NRC 2003).

Despite decades of use by private employers and government agencies, no field studies have evaluated the accuracy of screening tests in a manner that meets minimal scientific research standards (NRC 2003), and their use is therefore based on unsupported presumptions of utility. There is also no evidence to suggest that prior misdeeds are in fact useful predictors of future misconduct. For example, admissions of illegal drug use are commonly elicited by polygraph screening, but there is no evidence bearing on the extent to which they predict the future thefts, sabotage, or security violations that the polygraph screening is intended to prevent.

Further Difficulties of Polygraph Testing

Particularly in screening contexts, there may be an extremely low *base rate* of deception, which mathematically guarantees a large number of false-positive test results. For example, in the event that classified intelligence information is shared with a foreign power, there may be many individuals who had access to the information, only one of whom engaged in espionage. Screening all available suspects will inevitably yield many false accusations, and may in fact fail to identify the guilty individual. Altering the threshold for diagnosing deception presents policy makers with a choice between two unpleasant alternatives. On the one hand, setting a low threshold will increase the chances of correctly diagnosing deception in the examination of the guilty individual, yet it will also increase the number of false-positive results. All those who fail their tests will be indistinguishable by the polygraph alone, necessitating a large number of thorough investigations. As the NRC report notes, in the context of a low base rate and an assessment tool with as poor specificity as polygraph tests, it is easily possible that one might falsely implicate *hundreds* of innocent individuals in order to potentially identify the lone culprit. An agency may not have the resources to perform the required follow-up investigations, and there are a number of problems with revoking security clearances for all those who fail their tests. On the other hand, setting a stringent threshold will reduce the number of false-positive polygraph results, but at the cost of decreasing the odds of identifying the actual culprit and thereby defeating the purpose of the screening. Clearly, neither option is appealing, and the only way to improve matters is to develop an investigative tool more valid than polygraph testing or to restrict its use to situations in which the base rate of deception is not prohibitively low.

Another challenge for polygraph testing involves the high-stakes nature of many situations in which one wishes to diagnose deception. For example, a spy may be highly motivated to learn and practice effective countermeasures in anticipation of subsequent polygraph screening. Convicted spy Aldrich Ames passed several polygraph screening tests during his career at the CIA, which may have allayed suspicions of his misconduct far longer than would otherwise have been the case. Thus, when polygraph screening is used to clear individuals of suspicion, normal security precautions may be relaxed due to the false sense of security provided by the test results. The NRC highlighted this danger and advised caution in the use of polygraph testing for security screening. In contrast, innocent suspects may falsely believe in the validity of the polygraph and be less likely to engage in countermeasures and therefore more susceptible to failing polygraph tests. Or, the scrupulously honest individuals that one would wish to hold top-level security clearances may fear false-positive polygraph results and the damaging effects on their careers and choose to pursue other lines of work. Agencies that use polygraph testing for security screening purposes have suffered immeasurably from the flight of qualified employees who fear the repercussions of false accusations as well as an accompanying loss of morale among the employees who remain (NRC 2003).

Conclusions

As any proponent will quickly attest, polygraph testing has proven useful in eliciting confessions and admissions of wrongdoing. This provides considerable support for the utility of such testing as an investigative tool even if the tests themselves are of imperfect validity. However, such benefits are offset by a number of other weaknesses that suggest caution in drawing conclusions from any polygraph tests that fail to produce such confessions. Moreover, it is essential to verify the accuracy of a confession elicited by a polygraph test.

In 1993, the U.S. Supreme Court established criteria for the admissibility of scientific evidence, including general acceptance of the relevant theory and technique within the appropriate scientific discipline, a known or probable error rate that is satisfactory, standards that maximize the validity of a technique in practice, and publication in peer-reviewed scientific journals (*Daubert* v. *Merrell Dow Pharmaceuticals*, 1993). Whereas a strong case has been made for the inadmissibility of CQT results as evidence in court under the *Daubert* guidelines (Saxe and Ben-Shakhar 1999), pending successful field validation an equally strong case may be made for the admissibility

of GKT results (Ben-Shakhar, Bar-Hillel, and Kremnitzer 2002). Interestingly, most states prohibit admission of polygraph evidence in civil and criminal cases, but many individuals foolishly stipulate to the admission of test results. For example, in a criminal case that a district attorney wishes to close due to a lack of sufficient evidence or promising leads, a deal may be offered that many defendants find attractive: The charges will be dismissed if the suspect passes a polygraph test, but the test results will be admissible in court in the event that the suspect fails. Believing in the validity of the test and hoping to bring the ordeal of pending prosecution to an end, many suspects accept such an offer and are then surprised when they fail the test and thereby provide the state with evidence that many jurors find persuasive. Likewise, disputants in civil suits (e.g., both parents vying for custody of their children in a divorce) will sometimes agree to each take a polygraph test, with both sets of results stipulated in advance to be admissible. This, too, often turns out to be a foolish bargain. One can reasonably wonder whether other evidence of dubious validity should be allowed into the court record merely because both parties stipulate to it in advance (e.g., could the toss of a coin be used instead?).

In 1988, the federal Employee Polygraph Protection Act prohibited most private employers from using polygraph testing as a screening tool. Private firms, often the same ones that formerly administered large numbers of polygraph tests, have responded to fill this niche by offering paper-and-pencil honesty tests or voice stress analyzers that may be of even poorer validity (Lykken 1998; NRC 2003). However, it is curious that law enforcement, military, and government agencies were exempted from the prohibition on polygraph testing: A technique judged unsuitable for screening applicants to the local convenience store is still used to screen individuals responsible for maintaining our national security. It is time to carefully weigh the costs and benefits of polygraph screening in each particular context in which its use is being contemplated. The advantage of eliciting confessions and damning admissions must be considered against disadvantages such as invasions of privacy, damage to employee morale, the cost of investigating large numbers of false-positive results and the accompanying harm that is done to qualified individuals' careers, the possibility that the most dangerous individuals may be likely to learn and effectively employ countermeasures, and the false sense of security that can stem from the use of a highly fallible screening tool.

In its report prompted by the Department of Energy, the NRC offered recommendations that emphasize a number of steps to improve the practice of polygraph testing and safeguard our national security. The report encouraged research on the basic science relevant to the psychophysiological detection of deception such as the polygraph. Alternative processes and techniques that can supplement or replace the polygraph should receive serious study. This research should not be conducted by agencies with a real or perceived conflict of interest. For example, the Department of Defense Polygraph Institute is currently responsible both for the development and evaluation of polygraph techniques as well as training practitioners and promoting the use of the polygraph. Open scientific communication of research is also important, with results to be classified only when absolutely necessary to maintain national security. Above all, polygraph results should be interpreted with far greater caution than is currently evident, and policy makers should pay increased attention to the inherent tradeoffs of false-positive and false-negative identifications that stem from shifts in the threshold used to diagnose deception. The research program outlined above, along with a proper recognition of the strengths and limitations of the psychophysiological detection of deception, is essential to undertake a realistic assessment of the utility of polygraph testing.

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Note

1. Even this precaution does not guard against the possibility that examiners may construct or pose questions in a manner that biases physiological responses toward apparent deception or honesty in accordance with their preconceptions, but it does represent a minimally acceptable scientific procedure for evaluating the validity of conclusions drawn from polygraph tests. □

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"Polygraphs and the National Labs: Dangerous Ruse Undermines National Security." Alan P. Zelicoff. July/August 2001

"Lying About Polygraph Tests." Elie A. Shneour. Spring 1990

A Nobel Laureate Confronts Pseudoscience

A distinguished Russian physicist (co-winner of the 2003 Nobel Prize in Physics) battles the pseudoscience and charlatanism that he feels is duping his country's population. Two articles follow.

I. Demagogues against Scientific Expertise

VITALY L. GINZBURG

The fall of the totalitarian Soviet regime brought with it the elimination of censorship, among other things—a great achievement of democracy. But it is a great pity that the new freedom of the press very often turns into the poisonous propaganda of pseudoscience.

In 1998 a Commission to Combat Pseudoscience and the Falsification of Scientific Research was created in the Russian Academy of Sciences (RAN) as a step in this direction. The mission of the Commission is clear from the appeal of the Academy Presidium that was adopted. It begins thus:

> At the present time in our country parascience and paranormal beliefs are widely proliferated and propagandized: astrology, charlatanism, occultism, etc. Attempts continue to carry out various senseless projects at state expense, like the creation of torsion generators. The Russian population is being duped by TV and radio programs, articles, and books with openly anti-scientific content. The orgy of wizards, magicians, soothsayers, and prophets in Russian government and private media is unceasing. Pseudoscience is trying to penetrate all levels of society and all its institutions, including the Russian Academy of Sciences. These irrational and basically amoral trends doubtless present a serious threat to the normal intellectual development of the nation. The Russian Academy of Sciences cannot and should not view the unprecedented onslaught of obscurantism with equanimity and is obliged to give it a fitting rebuke.[1]

Unfortunately, the Academy's Presidium did not give the Commission sufficient attention. The entire "staff" of the Commission consists of a single employee who is often occupied with other work. I can also point to the publication of a book of the Commission's chairman, Academician Ed. P. Kruglyakov, *Swindlers Posing as Scientists* (2001), but in a laughable edition of only 2,000 copies. Of course, as we all know, the amount of money given to science in Russia right now is absolutely insufficient, but all the same this is billions of rubles a year. Somehow there should be enough to publish this book in a large edition, with free distribution to higher educational institutions, schools, etc.

My public and repeated appeals to add Ed. P. Kruglyakov to the large RAN Presidium and entrust him with creating a functioning Commission responsible for all such efforts have not as yet been heard.

Commission members HE. B. Aleksandrov, Ed. P. Kruglyakov, and myself have addressed a letter to the president of Russia, V. V. Putin, describing the current situation and concluding with the following suggestions: "1. Have an expert analysis with the aid of the RAN of any project based on the use of new laws of nature unknown to science (antigravity, torsion fields, etc.); 2. Develop a code preventing fraud and the duping of people through the mass media, the creation of an oversight council operating openly, but entrusted with the authority to put careless journalists in their place; and 3. Support the publication of popular science literature at the governmental level."

At our request, the president of the RAN, Academician Yu. S. Osipov, delivered this letter to the President's chief of staff in March 2001. We have not received a reply.

I hope all the same that something positive will be done about pseudoscience in the Russian Academy in the near future. Right now I want to make several comments clarifying some aspects of the issue of pseudoscience and the need to combat it. Personally, I have already tried to do this in several articles included in my book, *O Nauke, O Sebe, I O Drugikh* (*About Science, Myself, and Other Things*) (2001), and in the article "About Pseudoscience and the Need to Combat It,"[2] HE. B. Aleksandrov's article, and my own "About Pseudoscience and its Propagandists."[3] By the way, the latter has had an interesting fate. We had to place it in a low-circulation publication because a number of newspapers didn't want to publish it, inasmuch as one of the shameless propagandists of pseudoscience was named in it and "journalistic ethics" apparently prohibits newspapers from carrying such criticisms.

Suspicion sometimes arise among even respectable but uninformed people that promoters of new, productive ideas can suffer if scientists struggle against pseudoscience too strongly. In other words, "who are the judges?" and who are some elderly academicians to judge what is pseudoscience? For in the history of science, there are known cases when progressive views and new ideas have encountered sharp objections. However, such suspicions of ignorant people (the discussion is especially about demagogues) are the fruit of the purest misunderstanding. The problem is that all reasonable people (in any case, all members of the RAN Commission) understand pseudoscience as something that contradicts only firmly established truths and not merely controversial issues, new theories, etc. For example, in the case of the most well-known pseudoscience, astrology, it has been repeatedly proven that its horoscopes are obvious charlatanism.[4] And the same is true of pseudoscientific "perpetual motion" designs—in general, any mechanism whose operation contradicts classical (Newtonian) mechanics, which has been verified for 300 years (we're not talking here about relativistic and quantum allowances, which are also well known).

However, to expose these and similar pseudoscientific opinions and concepts we don't need the RAN Commission; competent engineers and specialists are quite sufficient for this purpose. The main task of the Commission is to critique more specialized and lesser-known issues. The projects using torsion fields are a good example. Modern physics knows of four types of fields: gravitational, electromagnetic, and the so-called "weak" and "strong" forces. In theory, other fields could exist, in particular, the so-called torsion field (or twisting field). A similar possibility has already been discussed for many years within the framework of the General Theory of Relativity. Appropriate experiments were set up in the U.S.S.R. and abroad which showed that torsion fields either do not generally exist in nature or are so weak that they could not be detected even with the most sophisticated measuring apparatus. Accordingly, they could not possibly be used for communications equipment or other practical ends. But there were charlatans who, shrouding themselves in secrecy, deceived military and KGB officials and received a large amount of money from them for their own (if one can call them) projects. All this has been described in detail in the literature cited above. The Commission (and specifically its members mentioned above) have been fighting and are fighting these charlatans.

It would seem that the situation is as clear as possible, but the "torsioners" are finding newer and newer defenders. One of them is Eh. V. Vaytsman, who published an article in September 2002 titled "Reactionaries Against Charlatans," and subtitled "Ordinary authors of scientific articles need to be protected against the caprice of 'underhanded opponents'." It has been a long time since I have had to contend with such demagogic rhetoric. Mr. Vaytsman also protects "torsioners," although he notes that "he is quite far from this problem"

(and, as I am convinced, doesn't even know what torsion fields are), but, on the other hand, instructs: "In fighting opponents it is unsuitable for academicians to use an academic administrative resource, including a so-called 'qualified body of experts'." But all of our "resources" in this case are just the knowledge of physics, which allows us to warn officials who are not skilled in it not to use government resources to support obviously worthless projects.

Each and every phrase in Vaytsman's article is a falsification or manifestation of arrogance. For example, he suddenly states that all three of us (Aleksandrovv, Kruglyakov, and myself) enjoy high-quality free medical services. He should be disappointed (or, on the contrary, glad?): I enjoy the services of the academic polyclinic, which is vegetating in poverty, and my colleagues who don't live in Moscow also are obviously not registered with the Kremlin Polyclinic. More important, what does this have to do with the issue of pseudoscience?

Scientific Works and the Review Process

I don't intend to hold a discussion with opponents of Vaytsman's type, but I consider it useful to illustrate one more way in which people are deceived. This is about the publication of scientific works; the assertion is that capriciousness is supposedly allowed in this matter, hindering the expression of new ideas. Accusations about the anonymity of reviewers, whom "fighters for justice" call "underhanded opponents," are especially popular.

What is the process of publication of scientific works accepted throughout the entire world, including Russia? It is the same more or less everywhere, but to be specific and to avoid any inaccuracies I will describe how work is conducted in the journal *Uspekhi Fizicheskikh Nauk* (*Successes of the Physical Sciences*), where I am editor-in-chief. Any article coming to the editor, including articles by members of the editorial board, myself included, are sent for review. The reviewer can be a member of the editorial board, but most often he plays the role of just one more reviewer. If the review is favorable but contains various critical comments, it is sent to the author for revision, then is usually sent to the reviewer again or to the appropriate member of the editorial board. As a result, if the article is chosen for publication, they edit it and send it to be printed.

Can it be done otherwise? Of course not. In the process, the author is obliged to accept the corrections, both in the Russian and the English versions (our journal is translated into English). All this is a quite laborious process, done by the entire editorial board and translators. If the review of the article is negative and the member of the editorial board who oversees this field and I agree with the negative conclusion, the author is informed that the article is rejected. Often the author does not agree with our conclusion and informs us of his counterarguments, and then the article is sent for comment to another reviewer and is considered again. Finally, sometimes after a second negative conclusion and my negative conclusion but when the author has new objections, the article is discussed at a meeting of the editorial board. In the course of this process the surname of the reviewer is given to the author only if the reviewer informs the editorial board of his agreement in writing.

Can it be done otherwise? Of course not. The review process, if it is honest, is not an easy matter. It is a service the reviewers offer to the editorial board. Naturally, in a majority of cases they don't want to start additional arguments with authors and then be subjected to insults, rebukes, accusations of incompetence, etc., which often happens in the case of uneducated or troublesome authors. Such a review process (which the authors of rejected articles sometimes see fit to call "underhanded") has, I repeat, been adopted throughout the entire world, is unavoidable, and is fair. Articles that are not published in one journal are often published in another, including those in another country. This is also a natural process.

Various journals have various requirements and often their own specific ones. For example, *UFN* is a digest type of journal and we can't even print valuable articles in full, but rather narrowly specialized ones which don't have quite broad content. There's no discrimination here; the size of the journal is limited and often a great deal of material must be rejected. In journals that publish only original work the selection criteria are different, of course. Doubtless there are mistakes in editorial work, not to mention controversial cases, but what does this prove? We need to try and work better, but it's impossible to print all the articles that come in. Such journals would hardly be subscribed to and read, the work of many people would be lost, and there wouldn't be enough money to publish thick volumes.

Unfortunately, the development of the so-called electronic press and the Internet are making this problem worse. Authors in a whole range of specialties can, without hindrance or review, place their articles on suitable Web sites. There even exists an opinion and a tendency to move everything to the Internet and stop printed editions. Many (I among them) vigorously oppose such an approach and consider it necessary to have paper journals. The review process and selection of articles by an editorial board are unavoidable. Those dissatisfied with such a method are often demagogues and uneducated people. I can only add that in my more than sixty years of practical work I do not know of an instance where a truly valuable work and idea in the field of physics was not published.

In conclusion, I want to return to the really important issue of the struggle against pseudoscience. Even if the RAN and, to no lesser degree, the Russian Academy of Medical Sciences (RAMN) do their duty to protect science in Russia from pseudoscientists, charlatans, and swindlers by shifting this matter to a Commission, the problem as a whole will not be solved. It can only be solved if all scientists and educated lay people are uncompromising toward obscurantism and fight against it.

There are various means available. I will share one of them, which I have adopted for myself. A correspondent from a well-known newspaper called me from time to time asking questions about science. Once I decided to ask whether his newspaper published astrological predictions. The correspondent informed me that, yes, the newspaper did publish them, although neither he nor the editorial board believed in them, but, you see, "the readers request them."

This is a typical case of the mass media duping the public in pursuit of revenue. I informed the correspondent that I would not answer his questions and in general have anything to do with his newspaper while it promoted pseudoscience. The journalist has not called me since. Obviously they continue to publish horoscopes, and unfortunately it's not hard to find more compliant consultants. I think that if the majority of members of the scientific community or at least the members of the RAN and RAMN boycotted the mass media that propagandize and encourage charlatanism we would achieve some success.

—Translated by Gary Goldberg

Notes

1. For more details, see *Vestnik RAN (Bulletin of the RAN)* N 10, 1999 and the newspaper *Poisk* N 23, 1999.
2. In the magazine *Nauka i Zhizn (Science and Life)*, N 11, 2000.
3. *Vestnik RAN* N 3, 1999.
4. See, for example, V. Surdin's article in *Nauka i Zhizn [Science and Life]*, N 11, 2000).

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*This is Dr. Ginzburg's article from a Russian newspaper (*Rossiiskaia Gazeta*) in reply to an academic who supports pseudoscience and has accused the RAN Commission of seeking to suppress daring ideas.*

II. Brave Thoughts Are Still Not the Truth

Scientists often take the bait of swindlers from pseudoscience.

VITALY L. GINZBURG

The Academician N.P. Bekhtereva's article "Censor of All Sciences?" forces me to make a number of comments regarding pseudoscience and my attitude toward it. Unfortunately, there are many obvious misunderstandings, confusion of concepts, and demagogy about this issue. I have already had to write about this more than once (in particular, in my book *About Science, Myself, and Other Things*, 2003). But I will have to repeat some things.

It would seem that the term *pseudoscience* speaks for itself—it is theories and statements contradicting scientific knowledge. But, you know, they are not static. Science is developing all the time and therefore, to put it bluntly, consists of two parts. First, from firmly established and repeatedly

Related Articles in Skeptical Inquirer

Special section "Science and Pseudoscience in Russia," with articles by Paul Kurtz, Yuri N. Efremov, and Edward Kruglyakov and text of a resolution against antiscience, charlatanism, and irrationalism in Russia, SI, July/August 2002.

confirmed scientific truths and laws. Second, especially in the field of new, so-called "frontier" directions—in science everything is in ferment and the struggle of ideas is ongoing. Some are victorious and others turn out to be incorrect and are thrown out by the scientific community.

Thus only theories, constructs, and statements contradicting firmly established facts and theories can be declared pseudoscience. Let's say that astrology is unquestionably a pseudoscience. Other examples of pseudoscience or, as they sometimes say, parascience, include various designs for mechanisms and instruments that supposedly operate in violation of the Law of Conservation of Energy or classical mechanics. But I must emphasize that it is of course impossible to declare ideas and theories pseudoscience that have not yet been refuted in an experiment or as a result of strict mathematical analysis.

All qualified scientists and, I daresay, all members of the RAN Commission to Combat Pseudoscience and the Falsification of Scientific Research, which was created in 1998, understand this. Its appearance was a somewhat belated and forced measure. An appeal adopted by the RAN Presidium characterized the situation [see the preceding article "Demagogues Against Scientific Expertise" for its text].

There is no room here to discuss the work of the Commission. An article by its chairman, Academician Ed. P. Kruglyakov, "Trafficking in Ignorance," published in June 2003, gives a certain picture of it. The facts cited in it are literally scandalous and demand a fitting reaction from the authorities and scientific community.

Unfortunately, the fight against pseudoscience has not drawn proper attention either from the RAN Presidium or other "state" academies (mainly the RAMN [Russian Academy of Medical Sciences]), nor from the so-called "public" academies. The attractiveness of the title "Academician" has led to the appearance of dozens of "academies," which are often far from modern science. It would be useful if these "academies" were to fight for the purity of science, including in their own ranks.

Here's a specific and recent example. It was reported in one of the newspapers that a Doctor of Technical Sciences and Academician of the Russian Academy of Natural Sciences (RAYeN), O. Grinkevich, developed a thermogenerator with an efficiency of about 200 percent, that is, in violation of the Law of the Conservation of Energy. Is it really not the duty of the RAYeN to verify the statements of its members? Not much is required to do this.

Now about N. P. Bekhtereva's article. With its subtitle, "There exists no authoritative criteria of 'correctness' in the knowledge of the new," I think the overwhelming majority of scientists would agree completely. But what does this have to do with the struggle against pseudoscience and the Commission's activities?

Unquestionably, no scientific statement can be considered pseudoscientific a priori. Ed. P. Kruglyakov does not declare the work of the associates of the Brain Institute to be pseudoscience; his criticism is mainly in regard to a phrase that figures in one of the interviews of the lead researcher: "Right now is the wrong time to express very bold ideas because the Academy has a Commission on Pseudoscience" and also her letter to President V.V. Putin with a proposal to "introduce a method of instruction in 'alternative viewing' in the country's special services."

The phrase cited seems no less insulting to the members of the Commission to which I belong than the words of its chairman which offended N.P. Bekhtereva. But, knowing what a "spoiled/tainted telephone" is and not having the original text of the interview and the letter to the President, I think it is impossible to discuss this issue in detail. Moreover, I should talk about my role in this "story."

In 2002, I was sent an article by N.P. Bekhtereva entitled "O pryamom videnii" ("Direct Viewing"), published in an academic journal, *Fiziologiya cheloveka (Human Physiology)*. At about the same time, corresponding member of the RAN V. B. Braginsky and Moscow State University Professor S.P. Vetchanin visited a "direct viewing" demonstration in one of the university's departments. They insisted that the children who were supposedly "seeing" with their eyes blindfolded also have their eyes covered with other bandages. Under such conditions the "phenomenon" disappeared. Therefore the Moscow State University professors concluded that in their "original" bandages the children were peeking, which was reported to the university's administration, where it seems that such demonstrations were stopped.

Since I am not a physiologist I didn't try to investigate anything, but on October 1, 2002, I wrote a letter to RAN Vice President N.A. Plateh (who oversees our Commission) in which I proposed that this matter be immediately investigated, for example by creating a commission of experts. And I also added, "To avoid misunderstandings I should stress that I do not suspect the associates of the RAN Brain Institute of pseudoscientific activity. I only suspect that they have fallen victim to swindlers, but, of course, this can only be proven after expert examination."

N.A. Plateh sent this letter to the RAN Biological Sciences Branch, which informed me that it was coordinating "the membership of an expert commission which would include representatives of the RAN who deal with problems of fundamental science and clinical specialists." Obviously they have not "coordinated" it yet, but we hope that an expert commission will be created at some point to clarify this question.

If this commission comes to a positive conclusion about the existence of "direct viewing," I will be only too glad to congratulate St. Petersburg scientists on a great scientific achievement. The suspicion that the Commission to Combat Pseudoscience is interfering with scientific exploration is completely unfounded. Like many of my colleagues, I think that press reports about sensational discoveries ought to be well-substantiated and verified. If this is only about assigning a priority, then it can be achieved by sending an official letter to the RAN. However, as far as I understand it, no question of a priority has arisen in the study of "direct viewing." □

Translated by Gary Goldberg.

Vitaly L. Ginzburg is with the P.N. Lebedev Physical Institute, Moscow, Russia, where he formerly headed the Theory Group. With Lev Landau, Ginzburg formulated a theory that explained in detail certain important questions about superconductivity. In December 2003, Ginzburg and physicists Alexei A. Abrikosov (Argonne National Laboratory) and Anthony J. Leggett (University of Illinois) were awarded the Nobel Prize in Physics for their contributions concerning superconductivity and superfluidity. E-mail: ginzburg@lpi.ru.

Natural Medicine: Will That Be a Pill or a Needle?

Many alternative practitioners promise to reveal "secrets your doctor never told you." One secret is never mentioned: why alternative remedies are ingested rather than injected. Though most practitioners of alternative medicine are silent on this question, this "missing information," as previously described by Kardes and Sanbonmatsu (2003), is crucial for evaluating the promised cure.

WILLIAM H. BAARSCHERS

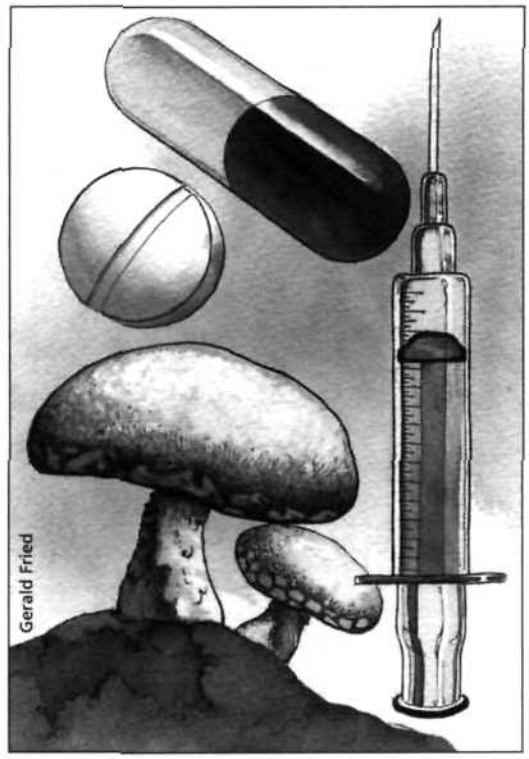
So-called natural medicines, usually herbs or supplements, are invariably things to eat or drink. And why not? Ever since the appearance of pharmaceuticals in the early 1800s, the doctor's prescription, legible only to a pharmacist, would nearly always get you something to swallow—a liquid, a pill, or a powder; an extract of senna leaves to relieve constipation, for example, or a "headache powder." Only occasionally would the prescription get you something to rub on your skin, like a salve. Today, medication still comes mostly in pill or capsule form.

By the late 1800s, Louis Pasteur's work with microorganisms brought about the first vaccines, for anthrax and rabies. BCG (bacillus Calmette-Guérin) vaccine against tuberculosis

appeared in 1921, and by 1955, Jonas Salk developed his polio vaccine. These vaccines could not be swallowed, they had to be injected. With a needle. But inflicting pain is unpleasant and discourages parents from bringing their children for vaccination. Therefore, Albert Sabin's 1965 oral polio vaccine was an important discovery.

The 1960s also brought the oral contraceptives—birth-control pills. Carl Djerassi, a chemistry professor at Stanford University known as "the father of the birth-control pill," preferred to call it "chemical fertility control." What was so special about *oral* polio vaccine and *oral* contraceptives? Did we not always swallow our medicines? Why were these oral medications such a breakthrough?

Although polio vaccine and birth-control pills are far apart in the pharmaceutical spectrum, the reason for the importance of "oral" is the same. Research often yields promising compounds that act on microorganisms or on cell cultures *in vitro*, in the shallow glass vessels called petri dishes. Next, the potential remedy is tested on animals, usually via a syringe. How does it get to be a pill? Or does it?



From Needle to Pill

Progesterone is a hormone secreted during pregnancy. One of its functions is to prevent the fertilization of other egg cells. It is *the* natural form of birth control, but it cannot be used as a pill. Progesterone is absorbed readily through the intestinal wall and is quickly metabolized on its first pass through the liver. Its half-life in the blood stream is about five minutes (Katzung 1998). Chemically modifying the progesterone molecule avoids this problem. That modification allowed the development of the Pill.

The moment we swallow something, what we eat starts on an obstacle course toward its destination. Enzymes in saliva begin the attack. Then the strongly acidic environment in the stomach alters many food molecules. Chemicals that survive this far face the digestive enzymes on their way through the small intestine. Eventually, some useful products of the breakdown of our food are absorbed through the intestinal wall into the bloodstream. Others are fermented by the bacteria in our colon, and still others are excreted.

More hurdles wait in the bloodstream. Portal blood carries absorbed food-derived molecules first to the liver, which can metabolize a chemical, be it food or medicine, before it reaches the systemic circulation. It's quite a steeplechase for whatever we eat.

Like the family doctor of old, alternative healers also give us pills or teas. After all, we have been conditioned to accept medicine as something we eat, never mind who recommends or prescribes it. But there is a difference between the alternative and the conventional. We invariably eat or drink the herbalist's prescriptions. But physicians, although they prefer to prescribe pills or capsules, must sometimes reach for the needle, because many effective drugs do not cope well with the rigors of our digestive tract. A drug's susceptibility to digestion or its poor absorption through the intestinal wall result in poor bioavailability. Such drugs must be injected to bypass the digestive system. The alternative-medicine approach rarely considers the bioavailability question.

Of an annotated list of North American prescription drugs, fully one third cannot be taken orally for these reasons (Springhouse Corporation 1996). They are injected, usually by a nurse or a doctor. In contrast, the complementary approach holds to the view that good medicine, provided by nature, comes from plants. It should be eaten, even if the extract must be sealed in a capsule. Strangely, although chemical laboratories are not kindly thought of by herb users, buying herbal extracts sealed into laboratory-made capsules does not seem to be a problem.

An early step in testing new drugs is determining how the drug reaches the target organ, how much enters the circulation, and how quickly it is metabolized or excreted. Without knowing this pharmacokinetic behavior, we cannot predict what happens after we swallow the pill, the capsule, or the tea.

A chemical called *amygdalin*, extracted from peach or apricot pits, was touted throughout the 1970s as an anticancer drug under the name Laetrile and became the subject of much controversy. While some alternative healers still believe Laetrile is a cancer drug, conventional medicine has rejected it. Laetrile molecules consist, in the chemical sense, of three smaller building blocks: benzaldehyde, glucose, and hydrocyanic acid. The last one is a highly toxic chemical, the "cyanide" of detective stories and gas chambers.

The reason for rejecting Laetrile is its pharmacokinetic behavior. When injected into cancer patients, it was quickly

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and almost completely excreted in the urine (Moertel et al. 1981). Given orally, it is rapidly split into its building blocks by stomach acid, causing elevated but nonlethal blood levels of cyanide. Since injected Laetrile is not absorbed, and if orally administered, the drug is destroyed by digestion, whatever it does to cancer cells in a lab is irrelevant.

Magic Mushrooms

Laetrile nicely illustrates the bioavailability problem with oral remedies, but there is a much more romantic example. The shiitake mushroom has an important place in both the food and the medicine of Asian countries, particularly China and Japan.

A mushroom's overnight appearance, seemingly out of nowhere, must have seemed like pure magic to our ancestors. No wonder mushrooms have been used as both food and medicine in virtually all cultures for thousands of years. Some were just considered good treatment for common ailments. Others were powerful "medicine," consumed by shamans in religious ceremonies (Schultes and Hofmann 1979). Hallucinogens in these mushrooms are closely related to dopamine and serotonin, chemicals directly involved in brain function.

Mushrooms are also food. The nutritional value of the shiitake is similar to that of other vegetables. It is about 90 percent water, some carbohydrates, some minerals, small amounts of vitamin C, and a little protein, although shiitake's protein content is only half that of the oyster mushroom (Chang 1980).

A little mycology, or fungus science, helps to appreciate the shiitake story. The often-invisible, underground part of a fungus is the mycelium, or vegetative part. It grows in soil, in wood, or other organic debris. The spore-bearing fruiting bodies are the actual mushrooms. They are formed only when conditions of temperature, humidity, and the fungus' stage of growth are just right. The shiitake belongs to the white-rot fungi, which grow on rotting wood and slowly break it down for the benefit of other forest dwellers. Mycelium of white-rot fungi, grown in culture, is used to biodegrade some food processing wastes (Vinciguerra et al. 1995). But it is the fruiting body, the actual mushroom, that goes so well with that juicy steak.

Shiitake mushrooms have played an important role in ancient Asian medicine because they contain two notable chemicals. One is reported to be an anticancer compound, and the other can lower blood cholesterol.

Mushrooms and Lemons

The reported anticancer effect of shiitake mushrooms has a prominent place in modern complementary-medicine literature. Although not always explicitly mentioned as a reason for eating the mushrooms, the suggestion is there when we see a story on the anticancer effects of shiitake illustrated with a fresh, delectable mushroom (McCaleb 1994). Other advice explicitly states that eating shiitake helps to resist tumors, whatever "resisting tumors" means (Bremness 1994). In North America, shiitakes are a tasty, luxurious companion to steak and red wine. Are they also an expensive medicine?

Shiitake mushrooms first appear in the scientific literature around the late 1960s (Maeda and Chihara 1971). The molecular structure of the isolated active compound, lentinan, was found to be that of a carbohydrate. Not very exciting—what could be more common than a carbohydrate? Nevertheless, numerous scientific reports on lentinan's anticancer potential have appeared during the past forty years, and they continue to appear. Lentinan appears to slow tumor growth, but most experiments are with cell cultures or small numbers of animals (Suzuki et al. 1994). Lentinan does not kill cancer cells—it is not cytotoxic.

Association of carbohydrates with the surface of cells plays a role in the "recognition" tasks of those cells—an important part of our immune system. Lentinan is believed to support those immune system tasks. Consequently, such chemicals have been called "immune-response modifiers." Similar carbohydrates are found in other mushrooms, like maitake and reishi. Chinese herbal medicines Hunang Qi (*Astragalus*) and Dankei (*Angelica*) are called immune modifiers in an American patent (Liu 1989). A carbohydrate found in ordinary wheat straw also has immune modifying properties (Nakahara et al. 1967).

There is more tempting news. Citrus pectin is also a carbohydrate, the soluble fiber we find in many fruits. News about citrus pectin in relation to prostate cancer was illustrated with a good-looking, juicy lemon (Webb 1997). The question is obvious: If forty years of research show readily available, cheap carbohydrates to be cancer-fighting and immune strengthening, why do we still not have a carbohydrate-type anticancer drug? Is the "medical establishment" missing the boat?

Cancer Drugs?

Let's start with the mushroom. Most of the literature reports on lentinan are in Japanese scientific journals, with English summaries in *Chemical Abstracts*—about a thousand studies in the past thirty-five years. What a remarkable interest in a gourmet mushroom. The critical question is: How was the lentinan applied? In a random sample of a couple of hundred of these reports, about two-thirds mention the use of injections. Some patents describe "injectable solutions" (Guo and Liu 1993). The remaining reports simply stated that lab animals were "treated" with lentinan. A rare citation mentions oral application.

Lentinan is a large carbohydrate molecule that would not be absorbed through the intestinal wall. Taken by mouth, lentinan is either digested, like starch, or more likely, it is a nondigestible carbohydrate, like pectin or cellulose (Noah et al. 1998). As a dietary fiber, either it will be fermented in the colon or it will be excreted. Lentinan, if it is a drug at all, would have to be an injectable drug.

The literature regarding lemon is different. It specifically mentions that *oral administration* of the *modified* pectin inhibited the metastasis of prostate cancer in rats (Pienta et al. 1995). The citrus pectin was quite extensively modified, by way of a well-established laboratory procedure for partially breaking down the large pectin molecules into much smaller fragments, which may well be small enough to pass through the intestinal wall. What reduced metastasis in the rats was not a "complex carbohydrate" but rather a much smaller molecule. Nobody knows, as yet, what the human digestive system would do to it.

And why citrus pectin? Because it is convenient and readily available from chemical-supply companies. Pectin from any other source, like apples, could well have given similar results (Nakahara et al. 1967). The lemon connection was coincidental. Illustrating the story with a fresh lemon made it attractive, but the research had nothing to do with eating lemons. The "herbal connection" was purely symbolic.

These studies are important. This is basic research that reveals interactions of specific carbohydrates with mammalian metabolism. Carbohydrates, the primary products of photosynthesis in plants, are abundant, cheap, and renewable. Plants make them in enormous variation and in huge quantities. They are used as food and food additives and in various medical applications. At least six herbal plants with a very high content of the so-called carbohydrate hydrocolloids, like pectin, are routinely used in Europe. Since carbohydrates interact so readily with other chemicals, including enzymes, a long list of "modified" carbohydrates has been developed to serve both the food industry and medicine (Franz 1989). Anticancer drugs are not on the list.

Policy Issues

Even if lentinan has to be an injectable drug, so what? We just found that nearly a third of all prescription drugs are injectable. Unfortunately, in the case of lentinan, the injection is not a good solution for getting around the digestion problem. The size of the lentinan molecule also causes problems for the needle.

Injecting large molecules like carbohydrates or proteins directly into the bloodstream provokes the body's defense systems. This is the basis of the rejection mechanism of transplanted organs. Large, foreign molecules are recognized by our immune system as invaders, like viruses and bacteria. Several research reports on lentinan comment on blood-vessel dilation and internal bleeding caused by the injections (Maeda et al. 1992). This is one of the reasons the American National Cancer Institute (NCI) excludes from further investigation all compounds that turn up in that organization's screening programs and that are either carbohydrates, proteins, or tannins—the large molecules that are likely to provoke immune reactions (Cragg et al. 1995).

Not all scientific opinion agrees with NCI's policy; investigation into the medicinal potential of carbohydrates continues in many places (Franz 1989). This work on carbohydrates is just another small battle in the "war on cancer," and it will probably carry on for a while. But so far, the carbohydrate approach has not yielded an anticancer drug.

Cholesterol and a Juicy Steak

A further, curious wrinkle in the shiitake story has to do with another killer, heart disease. Another chemical in this fungus was found to lower blood-cholesterol levels. The chemical, initially called lentinacin, first appeared in the literature in 1969 (Chibata et al. 1969). Shortly afterward, chemists changed its name to eritadenine. It was reported to be ten times more effective in lowering blood cholesterol than clofibrate, a first-generation synthetic drug for treating hypercholesterolemia (Spoerke and Rumack 1994). However, eritadenine disappeared from the science literature around the early 1980s. *Chemical Abstracts* indexes of the past fifteen years no longer mention it. Perhaps that is just as well. A synthetic preparation of eritadenine would, of course, be perfectly identical to what the mushroom produces. But it would have to go through the same costly testing protocol as other drugs before it could become clinically available. That would make it much more expensive than gourmet mushrooms.

The behavior of a chemical in our digestive system and in the bloodstream is very important. For legal prescription drugs, this pharmacokinetic behavior is studied and is known. For many herbal remedies and plant extracts it is not known. It is a secret your (naturopathic) doctor never told you. Many plant extracts have useful medicinal properties, but we need to know if we have to take them as a pill or through a needle . . . or as a juicy steak with mushrooms.

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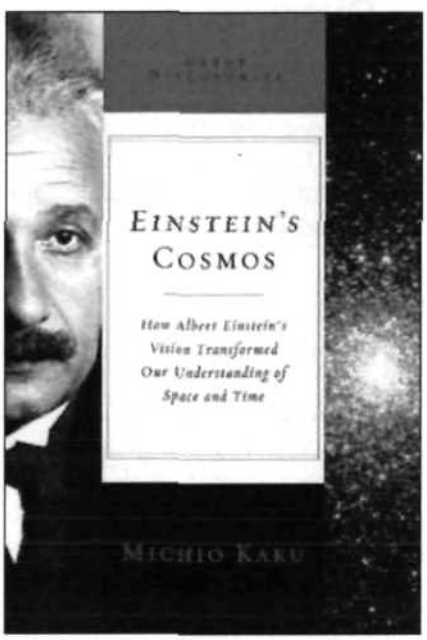
A Giant Standing on the Shoulders of Giants

GREG MARTINEZ

Einstein's Cosmos: How Albert Einstein's Vision Transformed Our Understanding of Space and Time. By Michio Kaku. Atlas books. W.W. Norton & Company, New York. 2004. ISBN 0-393-05165-X. 251 pp. Hardcover, $22.95.

The year 2005 brings the centennial of the publication of the seventeenth volume of *Annalen der Physik*, one of the leading academic physics journals of its day. This particular issue has achieved a legend all its own, because its contents included three papers by a hitherto obscure patent clerk and physicist named Albert Einstein. Addressing the topics of statistical mechanics, electromagnetism, and relativity, the author painstakingly and clearly laid out a vision of time, space, and the physical forces of the universe that would eventually transform our understanding of our place in time and the universe.

Einstein's "miracle year" of 1905 did not come about easily. As Michio Kaku depicts in his nimbly written and absorbing new biography, the path to this breakthrough was strewn with academic setbacks and hardships due to young Einstein's very individualistic learning methods. Balking at the pointless rigidity of German schooling, Einstein grew to become an accomplished autodidact both from orientation and necessity. Difficulties in the use of expressive language led instructors of the young Einstein to forsake his education, predicting a future of simple labor. His peripatetic family life (his father tried and failed at several businesses during Einstein's youth, resulting in many relocations across eastern Europe) also disrupted young Einstein's education. It is an irony treasured by countless parents that the muttering child forsaken by an inflexible educational system was in reality the greatest genius of the age, perhaps of all time. Einstein had to educate himself, but, more profoundly, he *could* educate himself, usually far beyond the abilities of his instructors.



This blazing mind singed more than a few egos, and his attempts at earning a doctorate or even a teaching position were actively thwarted by professors and administrators he had alienated with his superior intellect and impatience with their inability to recognize the gifts he possessed. He was finally awarded a doctorate just a few months before the publication of his landmark papers, while still working as a clerk in a Swiss patent office.

The reaction to these papers was muted at first, as the science community digested ideas that, if correct, would at the very least amend shortcomings in Newton's theories of motion, but, in fact, would cause an upheaval in contemporary views of time, space, gravity, and quantum physics. Eventually the theories were acclaimed, and as subsequent experimental testing of the theories validated Einstein's conjectures, his fame erupted from the enclosed world of mathematical physics into the nascent world of celebrity culture. In the time between the world wars, Einstein became the most recognized science figure in the world and one of the most famous by any measure.

This burst of fame roughly coincided with an increasing hostility toward Jews in Germany and Eastern Europe, hostility that was faced by even a nonobservant Jew like Einstein. His prominence made him a highly visible target for the rising Nazi movement. A German magazine published an edition listing perceived enemies of the Nazi movement with Einstein as its cover model and a caption reading, "Not yet hanged." In short order, Einstein fled to America, where his celebrity was fixed.

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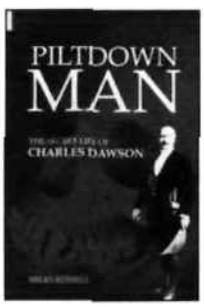
It was while in America, at Princeton University, that Einstein became the tousle-haired, pipe-smoking, sockless, and sweatshirt-wearing figure that is his widely recognized caricature. He spent his time in America working on a grand unified theory, the Holy Grail of physics, but with no success. He used his celebrity for activism (and irritating J. Edgar Hoover's FBI) and charitable works, seemingly enjoying a fame that baffled him, until his death in 1955. Kaku addresses these last few decades of Einstein's life with great sympathy and admiration. Most biographers gloss over this period as the fading glory of a once-great scientist, but Kaku argues persuasively that the groundwork for much latter-day research was laid during these years. As Kaku writes, "crumbs that have tumbled off Einstein's plate are now winning Nobel Prizes for other scientists."

Kaku's book, the third volume in W.W. Norton's "Great Discoveries" series of popular-science books, is a fine accomplishment, balancing a sensitive and sympathetic narrative of Einstein's difficult life with marvelously clear and lucid explanations of theories that are truly mind-boggling and genuinely awe-inspiring. As technologies have advanced, experimental science has been able to catch up with the thought experiments of a lonely patent clerk with a seemingly boundless mind, and he has been vindicated repeatedly. The first century of Einstein's influence has been remarkable and thrilling; one can only dream about what the second century may bring.



Bits of Bogus Science Preceding Piltdown

JOHN WHITTAKER

Piltdown Man: The Secret Life of Charles Dawson and the World's Greatest Archaeological Hoax. By Miles Russell. Tempus Publishing Ltd., Stroud, Gloustershire, UK. 2003. ISBN 0752425722. 288 pp. Softcover, £14.99 ($27).

There have been quite a few books on the Piltdown fraud, but this new one provides a good account, and by focusing on the life of the main figure, produces a convincing answer to the "whodunnit" of the hoax.

The basic story is well known: in 1912, Charles Dawson announced the discovery of a "missing link," a fossil with an ape-like jaw, but a human cranium. Dawson was assisted in his work at Piltdown by Arthur Woodward, Keeper of Geology at the British Museum, and the Jesuit naturalist Marie-Joseph Pierre Teilhard de Chardin. According to Dawson, he had actually found some skull fragments years earlier. The gravels also produced a few crude stone tools, an odd worked bone artifact, and some Pleistocene animal bones. A few doubters at the time questioned whether the mandible and the skull actually came from the same organism, a problem difficult to resolve since, significantly, the face of the skull and important parts of the mandible were missing. However, further work recovered more bits, including an ape-like lower canine found by de Chardin, that improved the reconstruction and helped satisfy some of the critics. Most important, Arthur Keith and other prominent evolutionary theorists of the day expected that since the brain was the most important development in human evolution, the earliest recognizable ancestral humans should have a large brain while retaining other ape-like features. Piltdown suited them just fine.

As paleoanthropological knowledge progressed in subsequent years, Piltdown at first hindered the acceptance of early hominid finds with teeth that looked more modern than their skulls. As these Australopithecines and others came to be accepted, Piltdown looked less and less authentic, and some scholars avoided discussion of the embarrassing black sheep of the human family. After Arthur Woodward died in 1944, chemical testing in 1949 and a further battery of tests and observations by some of the top players in 1953 showed that the doubters were correct after all: the cranium and mandible were not the same age or paleolithic at all, and the teeth had been filed to make a more human dentition in an ape's jaw. The bone tool was modern, and even the fossil rhino tooth and other bones came from elsewhere and were artificially stained to match.

To most, Charles Dawson has always been the most likely perpetrator. But at the time and since then he has had many defenders who point to him as a respected lawyer and amateur scientist with little motive for deceit and limited ability to create a large and complex hoax. Many others have been accused over the years: the Jesuit Teilhard de Chardin might have wanted to embarrass the scientific establishment, Arthur Woodward perhaps had a grudge against his museum superiors, and others at the time could have had varied motives, including a joke that grew until it was too dangerous to admit. Russell reviews all the suspects and finds none who would really have had the opportunity to plant a series of doctored remains, regardless of sometimes far-fetched theories about motivation.

Dawson himself was silenced by death in 1916, but in his life, he had earned a

John Whittaker teaches anthropology and archaeology at Grinnell College and has a particular interest in archaeological controversies and frauds, which are also discussed in his recent book American Flintknappers: Stone Age Art in the Age of Computers *(University of Texas Press).*

considerable reputation as an archaeologist. Russell's book is a detailed analysis of the scientific career of Dawson the antiquarian and naturalist. As a boy, he collected fossils and was befriended by geologists, donating finds to the British Museum and becoming a fellow of the Geological Society by the age of twenty-one. As he became a solicitor and entered the legal profession, science became his gentlemanly avocation. He continued to find fossils, helped found a museum, joined archaeological societies, performed a number of excavations, and published a series of reports that established his reputation for making important finds. The heart of Russell's book is a careful and readable examination of Dawson's record, case by case.

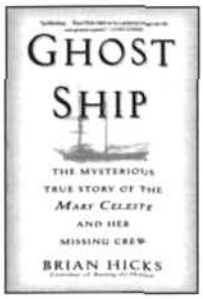
From abraded fossil mammal teeth in the 1890s (*Plagiaulax dawsoni*) to the doctored teeth of Piltdown (*Eoanthropus dawsoni*), Dawson is linked to a series of small frauds, salted sites, dubious reports, and borderline scholarship. Most were plausible and not so exceptional that they might raise eyebrows, but each improved the reputation of the author. The best of them solved interesting problems of the day, for example, bricks from the Roman fort at Pevensey with stamps that provided a Roman name for the site, a link to the last Roman emperor ruling Britain, and thus a date that made Pevensey the last major Roman project attempting to defend the island before the Empire abandoned it to the Saxon incursions. Dawson's report was published after Louis Salzman had begun excavating at Pevensey, but claimed that the bricks had been found some years earlier. Conveniently, Salzman found and published on a brick with a partial inscription, only readable in light of Dawson's find. However, the fabric and the writing on the bricks is not quite like other Roman brick, and modern thermoluminescence dates show that they are modern forgeries. Patterns emerge that are repeated at Piltdown: Dawson modifies genuine finds, creates new ones, misreports circumstances, and plants evidence to be found by others. In all, Russell finds some thirty bits of bogus science from the hand of Dawson.

In light of Russell's work, and that of others to whom he gives due credit, it is clear that Piltdown was only the last and best fabrication of Dawson's career. So many small deceptions had worked—why not try a really good one? He died before he could reap the full harvest of honors, and long before the progress of science would have exposed him.

From abraded fossil mammal teeth in the 1890s to the doctored teeth of Piltdown, Charles Dawson is linked to a series of small frauds, salted sites, dubious reports, and borderline scholarship.

The lessons for the skeptical observer of science are many. The moral usually preferred by scientists is that science, given time, will correct its mistakes and oust deception (see Massimo Pigliucci's column in this issue, page 20). A less optimistic reading is that among scientists, where truth is valued and good behavior is the expected norm, it is easy to put one over on your colleagues. There were good reasons for suspicion of Piltdown from the beginning: the disturbed circumstances of the finds, the uncertainty of the archaeological and anatomical connections between cranium and mandible, and the convenient discovery of supporting finds when they were called for. As in all good hoaxes, the desires and scientific agendas of Keith and other authorities steamrolled the doubts, substantially aided by the reputations and good names of Dawson and his duped associates. Dawson's collaborator Arthur Woodward, who was apparently a victim of the deception, spent the rest of his life defending Piltdown and continuing to dig at Dawson's sites. The supporting dupe who has too much to lose to recognize the truth is another common motif in frauds. And finally, while we may deplore *ad hominem* attacks as scientific arguments, Russell's biography of Dawson demonstrates that the background and scholarly record of a scientist may be of the greatest relevance in evaluating his science.

I found *Piltdown Man* a fascinating book. Each individual case is a quirky vignette of early modern science. Russell explains them well in their historical context, and provides the evidence to evaluate them, documents his sources, and reaches a firm conclusion. He explains details of the Piltdown story, and adds a new dimension to the shadowy life of Charles Dawson. There are a few redundant spots as one part of Dawson's life overlaps another, but on the whole the organization is straightforward. For the non-archaeological reader, better explanation of carbon dating and a few other technicalities would help. There are also a surprising number of small typos in a book otherwise up to Tempus's high standard. Good illustrations represent many of the finds and personalities. There are a few loose ends, as when the destruction of Dawson's papers in 1917 is mentioned but not explained, but on the whole this is a satisfying and well-written piece of historic detection that should be of wide interest.



The *Mary Celeste*: A Very Plausible Explanation

TERENCE M. HINES

Ghost Ship: The Mysterious True Story of the Mary Celeste *and her Missing Crew*. By Brian Hicks. Ballantine Books, New York, 2004. ISBN 0-345-46391-9. 288 pp. Hardcover, $25.95.

I first heard of the mystery of the *Mary Celeste* many years ago by way of a printed placemat at a restaurant on the outer banks of North Carolina. It told the story of the ship being found drifting in the Atlantic without lifeboats, with no crew aboard, hot meals still warm on the galley table, no signs of violence, the log book still on board, and the crew's possessions, including wet-weather gear, all present. All, or most, of the hatches were open. The crew was never heard from again. The question of why the crew left and what happened to them has been generating interest since the discovery of the *Mary Celeste* 500 miles west of Spain on December 4, 1872. The mystery became a national, even international, sensation. The fact that Captain Benjamin Spooner Briggs had his wife Sara and two-year-old daughter Sophia on board simply added to the interest in the event. Since then, there have been numerous attempts to explain why the crew vanished. The explanations have run from the mildly plausible (e.g., abandonment in a storm, mutiny, murder, pirates, insurance fraud) to the ludicrous (e.g., disappearing islands, UFO abductions, Bermuda Triangle effects).

Hicks tells the story of the brigantine *Mary Celeste*, starting with the building of the ship in Nova Scotia in 1861. It was not originally named the *Mary Celeste* but the *Amazon*. She had held her new name for only three years, when, on November 7, 1872, the ship sailed from New York bound for Europe with a cargo of industrial alcohol. Captain Briggs was a member of a distinguished sailing family from the famous maritime community of New Bedford, Massachusetts. He was an excellent sailor, with a well-deserved reputation for honesty. A interesting portion of the book is devoted to Briggs and his family.

A part of the story that was unknown to me until I read this book is what happened after the discovery of the drifting ship by the American ship the *Dei Gratia*. At considerable risk to both ships, the small crew of the *Dei Gratia* was split in two, with half going aboard the *Mary Celeste* to sail her to Gibraltar to claim her as salvage. It was expected that the salvage hearing would be a short and simple one. It was not. British officials, especially an admiralty-court officer named Frederick Solly Flood, turned the salvage hearings into almost a trial of the men of the *Dei Gratia*, whom Flood somehow suspected of foul play in the matter. The hearing lasted for months and ended up casting shadows on the reputation of the crew of the *Dei Gratia*. Toward the end of the proceedings, Flood even suggested that the missing crew of the *Mary Celeste* might have been involved somehow. In the end, the court did award prize money to the crew of the *Dei Gratia*, but the sum was much less than it should have been, the low amount being used as a punishment, even though the court could not prove any wrongdoing on the part of the crew.

Hicks also deals at some length with hoaxes and fictionalized accounts of the *Mary Celeste*, a section of the book I found among the most interesting. In fact, several of the well known "details" in the legend come not from reality but from fiction. The first was written in 1883 by Arthur Conan Doyle, before he created Sherlock Holmes. It was his first major literary publication and appeared anonymously in *Cornhill's Magazine*. It is in this tale that the story of the still-warm meals on the table first appeared. (No such meals were, in fact, found.) It is also from this story that the common misspelling "Marie Celeste" originated. The story tells of the experiences of a New England doctor who was a passenger on the ship and who escaped the murder of the entire crew. The story is written in the first person by the "doctor." It is clear now that the story has numerous glaring errors, but at the time, the incident was recent enough that the appearance of the story caused the ever-suspicious Flood to try to restart the investigation.

Doyle most likely intended his story as a piece of fiction, not a hoax. This was not true of other attempts outlined in the book. One told of the deathbed revelation of a servant to his employer, one Howard Linford, the "headmaster of a prominent prep school outside London." Linford cooked up the story of his servant's tale and published it in *Strand* magazine, ironically the place where the original Sherlock Holmes stories first appeared.

In any book about a mystery ship in the Atlantic, the topic of the Bermuda Triangle will appear, and so it does in this book. Happily, Hicks gives short shrift to the Triangle nonsense and cites Larry Kusche's superb debunking in *The Bermuda Triangle Mystery Solved*. Unfortunately, he does dwell rather longer than needed on the nonmystery of Flight 19. While he certainly doesn't give credence to any supernatural explanations, his description of the events does leave the impression that he thinks the whole thing is still very mysterious. Hicks is apparently unaware that Kusche has also thoroughly explained that mystery in his book *The Disappearance of Flight 19*.

Hicks's telling of the history of the *Mary Celeste* and the people and placed associated with her are all first-rate. But, of course, what really makes the book so

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interesting is the solution to the mystery that Hicks proposes. A common suggestion has been that the crew abandoned the ship in a storm and took to the lifeboats. But why would one abandon a large ship that was obviously seaworthy for a tiny lifeboat in a storm? Or perhaps the crew thought the ship was about to sink and thus took to the lifeboats. It is true that when the ship was found, there was some water in her bilges, but not enough to worry experienced sailors. And if they really thought the ship was going to sink, they would have taken at least some of their possessions with them, and certainly the wet-weather clothing. In the next paragraph, I will reveal Hicks's solution, which I find highly plausible. Since the book reads like an excellent mystery story, if you don't want to know the solution, stop reading now and buy the book.

While the crew did obviously leave the ship, they took nothing with them. Hicks makes an important point, one apparently not made before in the annals of the *Mary Celeste*: The crew took nothing with them because they *expected to come back to the ship.* The ship's cargo was wooden casks of alcohol. This had led to speculation of drunken rages on the part of the crew. But the cargo was most likely *industrial* alcohol, and when it was inspected, it was found to be largely intact, with, however, several casks empty, likely through evaporation. This would have meant that about 450 gallons of the chemical would have been loose in the ship's sealed hold in vaporous form, posing a serious problem. The only way to get rid of the fumes would be to unseal the hold. But the fumes would have been strong enough to be dangerous to the crew. In the weeks previous to December 4, that area of the Atlantic had had a time of very calm winds, a condition excellent for the buildup of dangerous fumes in the hold and very poor for any attempt at ventilation. Hicks suggests that as more normal weather returned, Captain Briggs ordered the ship "aired out." During that time, he, his family, and the crew went into the lifeboat that was tied to the ship by what was supposed to be a stout rope, the peak halyard. The plan was that after the airing out, they would pull and row the lifeboat back to the ship, and all would be well. But, in this scenario, a gale blew up quickly and the rope broke. In fact, the peak halyard was found snapped and hanging into the water when the ship was found. This rope, unlike the other rigging on the ship, was old and weak. So, the poor crew is left in the lifeboat as the *Mary Celeste* sails away on her own. A truly horrible and tragic death.

It seems to me that Hicks's account is the most plausible and parsimonious one yet proposed for the mystery of the *Mary Celeste.* It accounts for the more mysterious characteristics of the ship when found, such as the open hatches and all personal possessions as well as the wet-weather gear still being onboard. And it does so without the introduction of extraneous and unlikely events such as mass murder, waterspouts, UFOs, and the like. In short, Hicks has written the definitive work on this case. □

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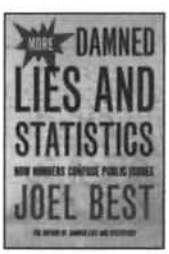
10. ***Backyard Ballistics***
    William Gurstelle

By arrangement with *Scientific American* (www.sciam.com), November 2004.

Listing does not preclude future review.

The New How Things Work: Everyday Technology Explained. John Langone. National Geographic Society, 2004. 272 pp. $35, hardcover. In a world where technological developments outpace our ability to understand them, John Langone, a science writer and former associate editor at *Time* magazine, has produced a science book that explains the inner workings of some of the most common technological devices that affect our lives. This is the sort of book that makes a good gift for children, liberally sprinkled with large, lush photographs and clear diagrams. Yet the text itself is sparse and written for adults, with each topic only given four or five paragraphs. The information is necessarily superficial, especially given the amount of space devoted to large and colorful—but not particularly informative—photographs. (Instead of a full-page stock photo of a handful of dead batteries, how about a simple diagram showing the positive and negative electron flow?) Since the Additional Reading section is positively anemic, each entry would have been better had they included sources for additional information. The book is hardly comprehensive but covers well over a hundred topics, such as automobiles, tunnels, synthetic fibers, digital cameras, glassmaking, laser surgery, photocopiers, and telescopes. Other, less obvious processes are explained in a few paragraphs such as elements of construction, sewing and knitting, and even the Stock Exchange. Entries are cross-referenced, and the book includes a glossary and index.



More Damned Lies and Statistics: How Numbers Confuse Public Issues. Joel Best. University of California Press, 2004. 200 pp., $19.95, hardcover. Over the past months of presidential election campaigning, hundreds of statistics have been tossed around by all sides: Numbers of jobs gained or lost, number of dollars spent on Iraq, percentages of unemployed or without health care, and so on. Some of the numbers are accurate, others purposely inflated or lowballed, still others seemingly plucked from thin air. To help us sort through this (often intentionally) confusing mathematical morass, Joel Best follows up his indispensable book *Damned Lies and Statistics*. In his new book, Best analyzes and evaluates dodgy numbers from across the social and political spectrum, including schoolyard bullying, the September 11 attacks, missing children, and the number of deaths caused by both lung cancer and falling coconuts. Through it all, Best provides dozens of examples of misleading statistics and shows that you don't have to be a statistician to identify bogus numbers and their use in fallacious arguments about social issues. Chapters include Missing Numbers, Confusing Numbers, Scary Numbers, Authoritative Numbers, Magical Numbers, and Contentious Numbers. Best concludes with a short but incisive discussion on how to improve the nation's statistical literacy. He points out that in school and college, "Statistics textbooks...all but ignore the sorts of issues raised in this book.... Statistics is usually understood as a branch of mathematics, hence the focus on calculation. But statistics classes largely ignore the ways statistics are used as evidence for understanding social issues as well as the ways people count." This book, like its predecessor, is essential reading for the public at large and skeptics in particular.

Bigfoot Exposed: An Anthropologist Examines America's Enduring Legend. David J. Daegling. Rowman & Littlefield Publishing, 2005. 288 pp., $72 hardcover, $25.95 paperback. In his new book *Bigfoot Exposed* David Daegling (an associate professor of anthropology at the University of Florida) guides readers through a forest of hoaxes, eyewitness accounts, and controversies within the Bigfoot community, often drawing upon his academic background. Daegling authored or co-authored several SKEPTICAL INQUIRER articles on Sasquatch, including "Bigfoot's Screen Test" (May/June 1999) and "Cripplefoot Hobbled" (March/April 2002). The book is divided into eleven chapters, among them The Natural History of Bigfoot, the Social History of Bigfoot, The Patterson Film, Three Red Herrings, and the Eyewitness Problem. Though there are dozens of books on the topic, *Bigfoot Exposed* is one of the first to seriously and critically examine the whole subject from a skeptical point of view. Daegling does not adopt a dismissive, debunking stance but instead examines the claims and controversies clearly and objectively, presenting several sides to arguments. The book's scholarship is also evident in its thorough documentation and voluminous references. *Bigfoot Exposed* should be of interest to believers and skeptics alike.

Kepler's Witch: An Astronomer's Discovery of Cosmic Order Amid Religious War, Political Intrigue, and the Heresy trial of His Mother. James A. Connor. Harper San Francisco, 2004. 402 pp. $24.94, hardcover. Richly told story of Johannes Kepler, the "Protestant Galileo" and the father of celestial mechanics and of much of modern optics, set amidst the backdrop of the Reformation and Counter-Reformation and showing not only the surprisingly spiritual nature of early modern science but Kepler's role as a neglected hero of conscience. The witch of the title was Kepler's elderly mother, Katharina, who was tried for witchcraft in a sensational trial that serves as the author's doorway to Kepler's life and times (he uses never-before-translated transcripts of the trial). A lively, human-oriented history of science and of human irrationality and worse.

True to Life: Why Truth Matters. Michael P. Lynch. Massachusetts Institute of Technology Press, 2004. 205 pp., $27.95, hardcover. Michael Lynch argues that truth matters, in both our personal and professional lives. Lynch examines theses including that truth matters, that truth is a worthy goal of inquiry, and that it is good to believe what is true. The dust jacket asks, "Why does truth matter, when politicians so easily sidestep it and intellectuals scorn it as irrelevant?" Lynch, an associate professor of philosophy, thankfully avoids the stultifying jargon and impenetrable prose that sometimes accompanies philosophical books like these. It is written for the intelligent lay reader interested in examining the basis for some (apparently) self-evident truths about truth. Lynch's discussion is lucid (if a bit dry in places), and he tackles postmodern philosophers who suggest that truth is subjective and irrelevant. A good companion to Sissela Bok's book *Lying. True to Life* is an insightful and timely examination of the ultimate basis for skepticism: that what is true matters.

—Benjamin Radford and Kendrick Frazier

It's a Bird, It's a Plane, It's . . . an Angel?

DAVE BROOKS

Rob Pudim

Logic is a wonderful thing—which makes it kind of alarming to find out how easily our minds will heave it out the window.

Ask Bob Peret, a Sun Microsystems software engineer, who was outside his Mont Vernon home one night when he and eight friends, relaxing after a mountain-bike ride, spotted a bizarre glowing object in the sky.

Here's how Peret described it in an e-mail: "It was approximately the size of the moon. It looked like two overlapping disks. I took out my binoculars, and . . . it looked like a horizontal line with wisps arching off the top and bottom on each side. It slowly drifted east-northeast, and faded away after about *an hour.*"

Very odd. But even odder, at least to Peret, was part of his reaction. He later recalled: "I'm an analytical person, I'm an engineer. But when my friend said, 'It looks like an angel,' I said, 'You know, it *does* look like the wings of an angel,' and for a split second it runs through my mind: 'That's an angel, and it's the end of the world!'"

Before donning sackcloth and ashes or carrying a sign down Main Street warning, "The end is nigh," however, Peret came to his senses. "Then I thought, nah," he said.

With such certainty is superstition held at bay.

As an enthusiastic backyard astronomer who has seen lots of odd stuff in the sky, Peret has more defenses than most of us against succumbing to the exotic lure of the unknown.

That lure goes something like this: "I can't think of a natural explanation for what I think I'm seeing, therefore it must have a supernatural cause." Poke hard enough and you'll find such a thought process behind most UFOs, ghosts, alien visitations, and what have you.

Peret knew several possible explanations for what he was seeing, although they didn't seem quite right. One is noctilucent clouds, which are so high up that the sun illuminates them long after it has set; another is exploding meteors, which create a debris cloud that can also catch post-sunset rays.

Still dissatisfied, Peret e-mailed me the next day (my helpful response: "I don't know") and then went to the Source of All Knowledge, the Internet. There, he hunted down an article on Space.com explaining what he had seen.

Turns out, his angel was a NASA rocket releasing excess fuel in the upper atmosphere at about 9 P.M. on August 31, 2004, after launching a National Reconnaissance Office satellite. "Dumping excess fuel is the usual practice for all Centaur-booster assisted launches," said the Space.com article. "It happens after spacecraft separation; the fuel bleeding off from a Centaur upper rocket stage on its second orbit after launch. Being just after nightfall, the cloud of fuel was still sunlit at that altitude."

The article included comments from several other puzzled observers from throughout the Northeast, so our local spotters weren't alone.

But it doesn't say how many of them found their worldview tottering for an instant. "For a split second I was ready to throw away everything I know about science," Peret said. "It's interesting to see how ready you are to give up everything you know."

Interesting, indeed. Thank goodness most of us don't succumb.

Do we?

David Brooks writes the weekly "Science from the Sidelines" column in The Telegraph of Nashua *(New Hampshire). This originally appeared on September 8, 2004. E-mail: brooksd@telegraph-nh.com.*

Stupid Things

RALPH ESTLING

"The twelve jurors were all writing very busily on slates. 'What are they doing?' Alice whispered to the Gryphon. They can't have anything to put down yet, before the trial's begun.'

'They're putting down their names,' the Gryphon whispered in reply, 'for fear they should forget them before the end of the trial.'

'Stupid things!' Alice began in a loud indignant voice. . . .

Alice could see, as well as if she were looking over their shoulders, that all the jurors were writing down 'Stupid things!' on their slates, and she could even make out that one of them didn't know how to spell 'stupid.' . . ."

—Lewis Carroll, *Alice in Wonderland*

I think I'm fairly safe in saying that it will probably not come as a terrible shock to readers of SKEPTICAL INQUIRER when I state unequivocally and in rather categorical terms my belief that a great many people believe in a great many stupid things.

Even when they have no particular difficulty in recollecting their names or in spelling *stupid*, human beings hold hard to nonsense of all sorts, varieties, and descriptions. And it appears that the greater the nonsense and less likely the truth, the harder the hold, in an eerie kind of inverse relation to the law of diminishing returns, so that when total nonsense and complete and utter impossibility is achieved, the hold is unbreakable, the faith unshakable, the unreason unshatterable, a citadel of credulity unassailable, invulnerable, a warhorse the Voice of the Whirlwind informed Job that saith among the trumpets, ha, ha.

Of course, we know this all too well for me or anyone to dwell on this remarkable quality of automystification. The real question I'd like to raise is this: Is there some sort of Darwinian selectivity involved whereby people and indeed, whole groups and nations which fervently cling to codswallop, the fantasy fanatics, possess an enhanced fitness for survival over the merely rational?

A cursory glance over the history of mankind would seem to suggest this. The question is: Would a much closer study of human societies over the past ten thousand years, from the end of the last Ice Age, say, and the beginnings of agriculture, reveal the natural superiority of individuals and societies that profited over other individuals and societies that espoused a slightly lower level of conviction in the demonstrably irrational?

There is nothing to be gained in comparing the unreasonable persons and societies with persons and societies possessing total reasonableness, because such persons are at best rather rare, and no such society has ever been known to exist. It is, I suppose, conceivable that some as-yet undiscovered tribe hidden in some jungled valley of Papua New Guinea or along some little-explored tributary of the Amazon exists whose members are, almost to a man and woman, completely sensible and fully cogent, but I think we should not spend too much of our time considering the likelihood. This fact alone points to the burden of my theme: Unrestrained imbecility and rampant insanity apart, natural selection favors the fantastically devout believer in absurdities.

Historians and cultural anthropologists would disagree. Darwinian selectivity favors the guy with the bigger brain, they maintain, the Cro-Magnon over the Neanderthal. I suggest they think more deeply. Cro-Magnons, in fact, had a slightly smaller brain than Neanderthals but admittedly that is beside the point, the point being that they had a better organized brain. But better organized in what kind of way?

Conceptually better. They could conceive vastly more, both physical and spiritual, than Neanderthals. In matters dealing with technology, this was a distinct advantage. They could conceive, and thereafter bring into being, the bow and arrow, the spear-thrower, the finely flaked axe, and teach themselves how to use these things with exquisite artistry. They could create beautiful paintings of the animals they were preparing to hunt and kill in ritual anticipation of the slaughter to come. They could dance around the fire in propitiation of the gods and appease the divine bloodlust with human sacrifice. The Neanderthal's

Ralph Estling writes from Ilminster, Somerset, England.

brain was not constructed to allow this level of insight into the spirit world. Moreover, Cro-Magnons had linguistic abilities far in excess of any possessed by Neanderthals. They could speak, converse, tell stories, and deal with matters that no Neanderthal could dream of doing. Cro-Magnons could thereby invent religion, with its gods and demons, a personified Nature of complete capriciousness and with a malevolence and vindictiveness that was wondrous to behold. A Nature like themselves; gods that were their mirror image. And, above all, Cro-Magnons could hate their fellow Cro-Magnons with a passion and tenacity that left Neanderthals out of the running, though by then there were no Neanderthals to run, having been in all probability exterminated in the first human act of genocide.

Organization is a marvelous thing. What could be more organized and more marvelous a spectacle to behold than a Nuremberg rally, with its flags, its trumpets, its serried ranks of thousands or tens of thousands of organized human beings, all shouting exactly alike, all thinking the same thing, the epitome, the apotheosis of Cro-Magnon organization.

Historians and cultural anthropologists and the human race in general favor the Cro-Magnon because of all this and because they, *we*, are Cro-Magnon's descendants, he is us, and therefore we hold him in the highest esteem. Add, too, the fact that it is always the victor who compiles the history books. We never have and never will learn the Neanderthal's slant on things. I remember a cartoon in *Omni* magazine that showed a Neanderthal writing on a cave wall "Cro-Magnons suck!" Neanderthals might well have thought something like this. Of course, the real point is that no Neanderthal could have *done* that. He was not sophisticated enough. But descendants of Cro-Magnon can.

Perhaps we had better rethink our ideas about stupid things and which, stupidity or intelligence, is nature's darling. Otherwise, the gods we invent in our complex, organized brains may scream at us out of the whirlwind as they screamed at Job when he had the temerity to ask why they were so unremittingly unjust, and point to the warhorse, who, in sublime contrast, asks no questions among the trumpets and only laughs. □

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Some Reasons for Caution about the Bigfoot Film Exposé

For skeptics, the revelation of a hoax can provide valuable insights but may also contain pitfalls.

MICHAEL DENNETT

Over the past three years, the Bigfoot community has been buffeted by the deaths of its two biggest proponents, René Dahinden and Grover Krantz. More recently, the death of Ray Wallace permitted his son and nephew to reveal that their relative had faked the "original"[1] Bigfoot tracks near Bluff Creek, California. And now, a book by Greg Long, *The Making of Bigfoot*, has seriously, perhaps fatally, damaged the credibility of the famous Patterson film. (For those readers not intimately versed in Sasquatch lore, the Patterson film has been the best photographic evidence for the possible existence of an unknown giant bipedal creature living in North America.)

Since the publication of Long's book, every issue of the *Bigfoot Times* newsletter has carried critical commentary on some aspect of the book. Editor Daniel Perez, writing in the March 2004 issue, said, "I think this book [*The Making of Bigfoot*] is junk. Don't buy it." In the following issue, Bigfoot researcher Peter Byrne called Long's work "amateurish, impetuous and careless." Yet a third reviewer writes: "In short Mr. Long's entire thesis is based on hearsay and personal opinions of those he talked with and the dubious claims by one man, Bob Heironimus; that it was him who wore the 'suit' on that October day in 1967."

But not all reviews have been negative. The often skeptical UFO newsletter, *Saucer Smear*, gave the book a good but qualified review,[2] and not surprisingly, the SKEPTICAL INQUIRER ran an article by Kal Korff and Michaela Kocis based on Long's book (July/August 2004). In their article, Korff and Kocis write: "After nearly forty years of secrecy, the truth behind the world-famous Roger Patterson Bigfoot film has been revealed. The man who actually wore the costume and played the role of Bigfoot in the film has been located and has made a full confession. Moreover, the husband and wife team who made and sold the Bigfoot costume that Patterson used to fake his movie have also confessed, and several other important eyewitnesses have come forth with corroborating evidence."

As a CSICOP Scientific and Technical Consultant, I feel that the Korff article may have overstated some of the issues. Having followed Sasquatch activities in the Pacific Northwest for over twenty years, I am well aware of the key issues related to the Patterson film, and many of the people in the Long book are individuals I have met or talked with over the years.[3] I believe it would be more accurate to state that Long has found a man, Bob Heironimus, who has provided a *most credible case* he was the man in an ape suit in the Patterson film. But *The Making of Bigfoot* does not, as Korff suggests, prove Heironimus's case. While I find Heironimus believable, there are glaring problems with the tale, and *SI* editor Ken Frazier has granted me this space to present a second perspective.

Significantly, Heironimus has no objective evidence that he was Roger Patterson's accomplice, despite a claim made to Long that he could prove he played the creature in the film. He does not have the "ape suit" or any other objective evidence. One of the two witnesses to Heironimus's brief possession of the "ape suit" was an eight-year-old boy at the time, and the other is Heironimus's mother. Some of the corroborating witness accounts are completely contradictory as well. Several people interviewed by Long claim that Heironimus showed them the "ape suit," a claim Heironimus strongly denies.

These conflicting testimonies show the weaknesses of such accounts and why as skeptics we must be cautious. If we are to believe the Heironimus account (and it is most plausible), how do we incorporate the other statements, made by honest-sounding individuals, who say they saw an ape suit in Heironimus's car when he clearly says they didn't?

Greg Long explains in his book that he made no payment to Heironimus, nor was any other financial gain a condition of the story being revealed. I am

Michael Dennett's first SI article on Bigfoot appeared in the Fall 1982 issue. Appropriately, the article was an account of a Bigfoot hoaxer coming forward to admit his involvement in the legend of Sasquatch.

sure this is true. However, Long does not explain why almost a year elapsed from the time Heironimus's attorney broke the story (but did not reveal Heironimus's name) and the time he contacted Long. A possible reason, not known to either Long or Korff, is that another writer was shopping the story to mainstream book publishers. I know this (although I did not know Heironimus's name at the time), because the writer, a former Yakima-area newspaperman, met with me and a colleague of mine over lunch. During our meeting, we were told there would be no book if there was no profit. It was my impression the (as-then-unnamed) hoaxer was a financial partner. I was skeptical the writer would find a major publishing firm interested in the story but offered to help verify, if possible, certain aspects of the account. If I am correct (and admittedly this is conjecture), Heironimus did have a profit motive. All this does not mean that the Heironimus account is untrue, simply that Long did not ask *all* the hard questions he might have during his multiple interviews.[4]

Korff tells us that Philip Morris, "who made and sold the Bigfoot costume that Patterson used to fake his movie," has confessed. The impression Korff leaves is that the Heironimus and Morris accounts agree, but they don't, at least not to me. Heironimus says that Patterson made the costume from a red horsehide, while Morris says his suit was made of an artificial fiber. Heironimus, who owned his own horse and went to rodeos, would presumably know the difference between horsehide and nylon fibers. Heironimus said the suit consisted of three parts: a bottom, a midsection, and a head, while Morris says the suit consisted of six parts, one for each limb, a middle section, and a head. Morris says the feet bottoms in his costume were black, yet they are white in the film. Morris says the arms could be extended by using sticks for the gloves, whereas Heironimus says nothing about any arm extensions. In fact, if the Morris costume had "gloves" it would have consisted of eight parts, not the three described by Heironimus.

Korff then goes on to explain: "Morris distinctly told Patterson how to hide this zipper from view, advising him to comb down the fur on the suit with a brush. Sure enough, this Bigfoot, a wild creature presumably living in the wilderness, is remarkably clean and carefully groomed." I don't know how many wild animals Korff has seen, but of the hundreds I have had the chance to observe, including a big black bear last year, I cannot remember a single unkempt animal.

Perhaps a bigger problem with the Morris story is Patterson paying for a suit even though Long's book spends at least a hundred pages explaining how talented Patterson was at making things and how he seldom paid for anything, especially something he could construct for himself. As a skeptic, I am unable to accept Morris's story, for I find the account of Patterson's resourcefulness, artistic capabilities, and lack of capital much more believable. Long does establish, beyond any reasonable doubt, that Patterson was a man with the ability, aptitude, and motive to fake a Bigfoot film. He does this through multiple interviews with people who were both friends and victims of Patterson and then supplements testimony with objective court records, contracts, and photographs.

As skeptics, what would we do if someone with a more credible account of perpetrating a hoax stepped forward tomorrow? Certainly, one would think that Korff would have considered this possibility, for in the television documentary *World's Greatest Hoaxes* (a program he was featured in), a man named Jerry Romney, not Heironimus, is identified as the "man in the ape suit." Romney is even shown doing an impressive simulation of the "walk" in the Patterson film, sans the suit.

What the two accounts by Morris and Heironimus illustrate is how convincing both accounts can be, when only one can be correct. I find it interesting to read *Bigfoot Times* and note how skeptical of witness narratives all the Bigfoot proponents have become. When the point of Heironimus having no profit motive came up, at least one Bigfoot proponent pointed out how people will say things for the strangest of reasons, many of them incomprehensible to others (something skeptics have known for a long time). When the accounts favor a more prosaic view, can Bigfoot doubters be any less skeptical?

Long has found a man, Bob Heironimus, who has provided a most credible case he was the man in an ape suit in the Patterson film. But *The Making of Bigfoot* does not, as Korff suggests, prove Heironimus's case.

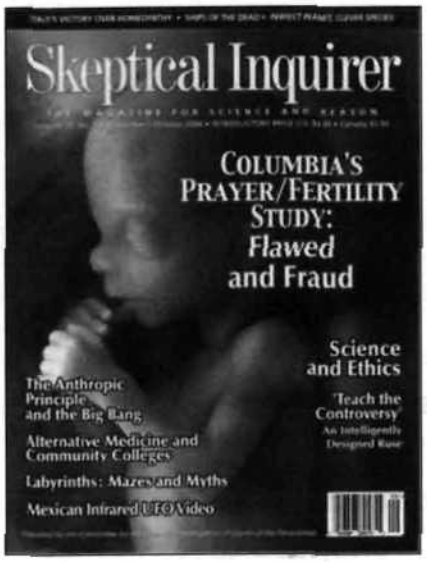
Notes

1. The legend of Bigfoot predates the famous August 1958 discovery by Jerry Crew, near Bluff Creek, California, of a series of Bigfoot prints. But an AP story and, later, a *True* magazine article pumped new life into the tale, and a "modern" era of tracks and sightings began. Significantly, this is the same area where Patterson filmed the famous footage. For an excellent account, see Mark Chorvinsky's "Our Strange World," *Fate* magazine, July 1993 and November 1993.

2. The *Saucer Smear* article (appearing in two parts in the May and June 2004 issues) was written by co-editor Karl Pflock, and although it praises the book, it also voices reasonable reservations.

3. For additional reading on Bigfoot, see my articles in *SI*, Spring 1989, "Evidence for Bigfoot?" and Fall 1994, "Bigfoot Evidence: Are These Tracks Real?"

4. Long is a first-class interviewer, yet there are basic limitations to the interview format, especially if the subject wishes to withhold information. □


Skeptical Inquirer
COLUMBIA'S PRAYER/FERTILITY STUDY: Flawed and Fraud
Science and Ethics
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Exposing Columbia's Prayer/Fertility Study

Bruce Flamm ("The Columbia University 'Miracle' Study: Flawed and Fraud," September/October 2004) writes, "The study's results could only be described as miraculous. This was welcome and wonderful news for a shaken nation." I first read about this study in the issue of the magazine *The Week* dated 19 October 2001, in which Rogerio Lobo (described as a "Columbia University researcher") was the only author mentioned by name. I was still, of course, profoundly shaken by the September 11 attacks, but, as an alumnus of Columbia, I did not consider this study to be "welcome and wonderful news." I immediately sent the clipping and the following letter to the Columbia newspaper, the *Columbia Daily Spectator*:

> What is this garbage? Who *is* this guy? It's easy to believe that Congress can be simple-minded enough to give credence to Elizabeth Targ and her crew of creedbound dimwits, but Columbia University? My Columbia? I suspect that someone is plotting to devalue my degrees to the level of the ("state-authorized"!) Kepler College of Astrological Arts and Sciences in Seattle. (I'm not making this up, you know.)
>
> Very truly yours,
> Max Siegel

Unfortunately, I do not know if this letter was ever published in the *Spectator*, but I do believe that an outpouring of outrage, disbelief, and ridicule from alumni whenever a major educational institution commits a gaffe of this magnitude would go far toward sensitizing administrators and public-relations personnel to the consequences of being credulous and naive about less-than-scientific studies.

Maxwell E. Siegel
Sussex, New Jersey

Grateful thanks are due to Professor Bruce Flamm for his painstaking and decisive pricking of yet another (this one apparently impregnable) "efficacy of prayer" balloon.

If, as seems probable, the "study" was entirely fabricated (not the sort of *Gedanken* experiment Einstein had in mind), the need for replication and confirmation by others is emphasized as the only way science can purge itself of fraud and error.

Those who believe in prayer must be constantly dismayed by the capriciousness and apparent cruelty of the Almighty. In the present report, many of the women in the nominally "not prayed for" group must have indeed been prayed for, long and fervently, by their nearest and dearest. What are we to make of a God who is deaf to the entreaties of people's loved ones but bends the Divine Ear to the requests of strangers?

Bernard Howard
Christchurch
New Zealand

Dr. Bruce Flamm's behind-the-scenes work on the Columbia University prayer study was a great example of how the public can be deceived through legitimate sources of information (*The Journal of Reproductive Medicine*). I can see why the authors would not want to talk with Dr. Flamm, as they presumably knew about their own biases, agendas, and histories. But I wonder why the *JRM* would not answer questions from Dr. Flamm. I wonder when they knew they had such a stinker of a research paper on their hands.

I also found on the Web at www.biomedcentral.com/news/20040614/04/ that Harold G. Koenig at the Duke University Medical Center, who studies the relationship between spirituality and health, cautioned that whether the report contains falsifications still remains unknown. "It could be a completely legitimate study," he noted. He also told *The Scientist* that Flamm is a "known skeptic."

I guess from Koenig's perspective, it is better to be swayed by a "known criminal" than a "known skeptic."

Carl Perrin
cperrin@cableone.net

I have little doubt that the study reported by Cha et al. on prayer increasing IVF success is flawed and/or fraud, as suggested in the Editor's Note and Bruce Flamm's article. It should come as no surprise that, as a subscriber to SKEPTICAL INQUIRER, I expect claims to be backed up by evidence and sound reasoning. That said, nothing in the September/October issue did anything to increase my certainty that the Cha et al. study was inaccurate. Neither the Editor's Note nor the Flamm article provided evidential or rational arguments against the conclusions drawn by Cha et al. The presentation presuming to refute the claim of prayer-induced increases in fertility consisted primarily of: 1) an attack on a portion of the study (prayer groupings) that appears irrelevant to the overall conclusion, 2) an "appeal to authority" (Occam's razor), 3) a personal attack on the source (for potential unethical behavior in other contexts), and 4) a preconceived disdain for any paranormal claim.

I will not be renewing my subscription.

Jeff Hollerman
jhollerm@allegheny.edu

Clinical studies of "healing prayer" get me thinking about what would happen if such studies actually showed a meaningful positive result. It seems that before long someone would want to know what parameters lead to the overall success. Was it the number of people praying? Perhaps the wording of the prayers was significant, the religious affiliations of the prayers (or perhaps of the healed/helped).

Follow-up studies with modified parameters would try to identify the critical variables. Should prayers be directed at God, some particular saint, or other deity? Are there particular people who are more effective than others at praying, and why: denomination, credentials, piety, etc.? How many people are necessary for praying effectiveness?

Of course, all of this would raise even more interesting philosophical questions. If God has a plan, why can he be persuaded to modify it? Is God susceptible to group pressure? Why can a group of people who don't even know the target person of their prayers be more effective than the family and friends of the afflicted? Unfortunately, these questions wouldn't be answered by clinical studies.

Robin McMeeking
Pinckney, Michigan

Bruce Flamm replies:

My sincere thanks to those who took the time to write letters about my investigation of the flawed Columbia University "Miracle" Study. As for Mr. Hollerman, I must point out that the SI article was too brief to include an in-depth analysis of the many flaws in the Cha/Wirth/Lobo study. My critiques published in the Scientific Review of Alternative Medicine *give more comprehensive explanations. In any case, a study design that is bewildering and virtually incomprehensible cannot be called irrelevant to the study's overall conclusions and invoking Occam's razor is not an appeal to authority but rather an appeal to sound principles. An* ad hominem *attack against one of the authors would be unfair if, as you suggested, it focused on "potential unethical behavior" in "other contexts." However, there is nothing "potential" about the author's unethical behavior and it is not in "another context." The author in question, Daniel Wirth, recently pled guilty to multiple felony fraud charges and possible fraud is a key issue surrounding the Cha/Wirth/Lobo study. Finally, I cheerfully plead guilty to being skeptical of paranormal and supernatural claims.*

Anthropic Principle Examined

After reading "The Anthropic Principle and the Big Bang: Natural or Supernatural," (September/October 2004) I can only say that scientists can never say they fully understand the universe. When scientists feel they understand the universe by looking through their Hubble telescope, they then find out more new and mysterious things about the universe that they are unable to explain. Now there is a theory that there was a universe before our universe existed and the Big Bang could have happened many times before, creating various new universes. The universe could be a continuing recycling machine: it diminishes to nothingness, then it starts anew with another Big Bang, and, *voila*, a new universe is created. We will never have all the answers, so we shouldn't try.

Paul Dale Roberts
Elk Grove, California

Mark Perakh's analysis of the assumptions behind the anthropic principles is needlessly complicated.

"Abduction" is a fancy name for hypothesis generation. In fact, Meyer and Dembski present a hypothesis to explain the Big Bang. Universes are not usually created by Big Bangs, they claim ("surprising fact"), but supernatural creators do it usually with Big Bangs or at least more often so than natural processes. (Genesis?) Clearly, they assume quite a lot about physics and supernatural beings.

Bayesian analysis is a sledgehammer to crack this nut. Bayesian analysis is fine if one deals with chance events, i.e., events for which it makes sense to discuss their probability.

But "the probability of a supernatural creation of the universe" doesn't exist. There are no conceivable experiments that yield an estimate for such a probability. Skeptics should stick to science and not use undefinable probabilities. The same holds for fine-tuning for life. Life other than the kind we know is hard to define, and the "probability that the universe is fine-tuned for life" is another of those unnecessary entities Occam warned us about.

Jan Willem Nienhuys
Waalre, Netherlands

Mark Perakh makes a good case against the necessity of a deity in the origins of the universe. However, is there really any evidence for such a principle in the first place? The principle, at root, rests on the "Goldilocks" concept of the universe being "just right" for organic life (and, more specifically, for organic sentient human life).

At the present time, the human race, and, so far as we presently know, all organic life, is confined to a single, small planet which does indeed provide "just right" conditions (though, of course, much of that is due to our adaptation to the planet, not vice versa). However, the vast emptiness of space is totally hostile to humanity (lack of air, deadly radiation, no TV dinners, etc.). All the other moons and planets that we can study have, to date, proved equally inhospitable. And even most of the Earth (deep oceans, arctic wastes) is hardly what one would call inviting.

If the anthropic principal did indeed exist, the evidence would surely be that the universe was created for a being that existed in the vacuum of space, not one confined to a tiny speck in one corner of a cold, desolate cosmos.

Tim Hill
Woodinville, Washington

Do we really believe that the universe is truly fine-tuned for life? With humanity forever at war and nearly all life-forms destroying one another to survive, one has to wonder, why the fight over bragging rights for this subject?

Charles Karelitz
Honolulu, Hawaii

Mark Perakh's article brings to mind a *Frank and Ernest* cartoon from many years ago which represents the same idea with wonderful succinctness. The disheveled duo are standing in the C.I.A. building in front of the building directory. The directory featured a large arrow with the message "You are here." Frank observed to Ernest, "They sure keep track of you, don't they?"

Norman P. Carlson
Busti, New York

'Teach the Controversy'

Robert Camp's excellent article, "'Teach the Controversy': An Intelligently Designed Ruse" (September/October 2004), overlooks a certain ambiguity in the slogan "teach the controversy."

Originally, when the phrase appeared, it was indeed used, as Camp says, to represent "Intelligent Design" as "a combatant in a scientific controversy." Increasingly, however, the Discovery Institute's Center for Science and Culture—the main institutional home of "Intelligent Design"—is disclaiming any desire for "Intelligent Design" to be taught in the public schools. "Teach the controversy" is now frequently used to describe the idea of teaching evolution's "strengths and weaknesses," or evidence "for and against" evolution, which in practice means misrepresenting the mainstream scientific literature in such a way as to confuse the public in general, and students in particular, about the scientific standing of evolution. The goal, of course, is to promote creationism.

In the wake of the Supreme Court's decision in *Edwards* v. *Aguillard* that teaching "creation science" violates the Establishment Clause of the First Amendment, the Institute for Creation Research recommended the same approach: "school boards and teachers should be strongly encouraged at least to stress the scientific evidences and arguments *against evolution* in their classes . . . even if they don't wish to recognize these as evidences and arguments *for creation*. . . ."

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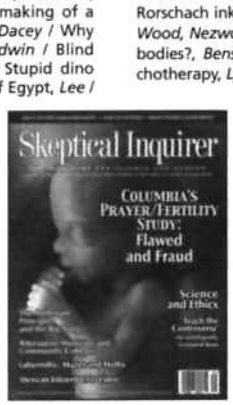

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So whether "teach the controversy" is invoked to portray Intelligent Design as scientific or merely to portray evolution as a theory in crisis, the point is the same: to challenge science in the service of a narrow religious agenda.

Glenn Branch
National Center for
Science Education
Oakland, California

Robert Camp writes that ID proponents "try to soft-pedal their goals, appearing to desire only to have evidence for and against biological evolution covered in science classes. But this is already the case. . . . To propose that one desires only that 'evidence for and against' evolution be taught . . . is . . . utterly banal." Camp further states that one ID pressure group advocates that schools "(a) teach the evidence for and against biological evolution" and " (c) adopt a definition of science that allows for consideration of all logical explanations for phenomena in nature." Then he writes "Of course, no reasonable scientist, or layman for that matter, would argue against either . . . option. Both are wholly noncontroversial and are matters of scientific procedure."

Camp views (a) and (c) above as an innocuous smokescreen to package a third unpalatable request, (b), to also permit "alternative theories such as Intelligent Design" to be taught. Exactly which schools does Camp have in mind in which "evidence both for and against . . . evolution" is being taught—and where the "evidence against evolution" is somehow being presented in a way consistent with the various court decisions of recent years? Exactly what sources for the supposed "evidence against evolution" are being used by the teachers? What sources are they likely to find outside of the Creationist literature? Should these teachers also be teaching the "evidence against" heliocentrism, the microbe theory of disease, atomic theory, and the other central theories of science? Is "a definition of science that allows for consideration of all logical explanations for phenomena" problematical from the pedagogical point of view, when what is meant by "logical" is vague and controversial and when it may appear as if there is an infinite number of "logical" explanations? How "logical" is quantum/particle physics likely to appear to most students?

Ronald H. Pine
Research Associate
Field Museum
Chicago, Illinois

The "controversy" between evolution and Intelligent Design is not scientific but religious. Therefore, the proper place to teach this controversy is a comparative religion class. In fact, in my twenty years of speaking to public-school comparative-religion classes, the evolution/creationism question has never failed to come up. It has been an excellent opportunity for me to explain the difference between science and religion, between evidence and faith. The class can also appropriately teach the many divine-creation myths in which people have believed. Public schools can teach about religion in the appropriate venue. However, they can't teach religious guesses as fact, especially in a science class.

August Berkshire
President
Minnesota Atheists
Minneapolis, Minnesota

While I agree that the teaching of Intelligent Design vs. evolution is not the teaching of two different scientific theories, maybe an alternative is to teach competing versions of Intelligent Design. The version the religious Right wants to teach suggests that God is the intelligence behind the design. I suggest that *Star Trek: The Next Generation* has an equally plausible theory. That show suggested that a very old civilization "seeded" the universe. Both of these Intelligent Design theories are equally provable, therefore both should be taught.

Alan H. Weiner
Albuquerque, New Mexico

Science and Ethics

Ethicist Leon R. Kass, the chair of President Bush's Council on Bioethics, sent this letter directly to Paul Kurtz in response to Kurtz's article, "Can the Sciences Help Us Make Wise Ethical Judgments?" (September/October 2004). We print it here with his approval, and Kurtz replies.—EDITOR.

Someone just sent me the text of your very interesting essay from the SKEPTICAL INQUIRER, adapted from your Toronto talk earlier this year. Though we do not see eye to eye on all matters, I appreciate much of what you had to say. Indeed, I too have been interested in nature and ethics for several decades, though I do not hold the modern penchant for reductive explanations as providing a sufficient account of nature, animal no less than human. (You might be interested in two efforts along these lines: *Toward a More Natural Science—especially* chapters 10–13; especially 13—and *The Hungry Soul: Eating and the Perfecting of Our Nature.*) But I would not have taken up the electronic pen were it not for your mistaken presentation of my view on human embryos.

You claim that "He maintains that all human life, including a cloned embryo, has the same moral status and dignity as a person from the moment of conception." I do not maintain this, and I have never said this. In fact, I have said in print that I am inclined to doubt this view, though I also remain agnostic on the question. I do not *know* with confidence how to regard the early human embryo, and I doubt that people who claim such knowledge—on either side of the debate—really have it. I do think that any honest biologist in the presence of an embryo—animal as well as human—would be in awe of its indwelling powers of organic and integrated self-development and ontogenesis and would never succumb to the temptation of seeing it as "just a bag of cells." It is an organism at the early stage of development—but that still leaves open the precise moral standing that it should command among us, and I have never said that the embryo is a person or its equivalent.

I have said that one need *not* believe that an early human embryo is fully one of us to be troubled by the idea and practice of regarding it as mere raw material for our own, albeit humanely inspired, use. That disquiet concerns less what we do to embryos than what we do to ourselves. As a policy matter, I do oppose all human cloning, including the creation of cloned embryos for research but not for the reason you have ascribed to me.

I thought, for the future, you would like to have this error corrected.

Leon Kass
Washington, D.C.

Ironically, I share with Paul Kurtz many of the same personal values ("Can the Sciences Help Us to Make Wise Ethical Judgments?" September/October 2004). I am nonreligious but work at being moral and ethical. It would be reassuring if we could find a scientific basis promoting good behavior. Unfortunately, Kurtz's attempt fails, because he falls (as so many have before him) into relying on circular reasoning.

Kurtz dismisses "objective relativism" because of its "dire consequences" as when it

was applied in Nazi Germany. He then asserts, "scientific knowledge has a vital . . . role to play in shaping our moral values . . . surely more than our current reliance on theologians, politicians, military pundits, corporate CEOs, and celebrities!" Both statements are presumptuous. The first assumes that the slaughter of millions of innocent people is a bad thing. While I personally agree that this is a bad thing, that's my adopted stance. It is not proof that our shared desire is intrinsic to nature, which does, after all, waste millions of sperm in order to gain a single pregnancy. So, Kurtz has already selected at least two outcomes he desires—a value system that condemns the slaughter of innocent people and a system that does not rely on people with whom he often disagrees. (And darned if I don't hold those same values, myself.) Then he proposes a "naturalistic ethics" which would be open to rational inquiry, where we would select those ethical and moral values that work, discarding those that don't. He claims we have a body of "prescriptive ethical judgments" to go by. But who exactly has agreed upon these values? To use one of his examples, is it okay to execute an evil person if it deters other evildoers but not if it doesn't? Why? Doesn't this presuppose that deterrence is good but retribution is not? Who says so? In fact, revenge has survived thousands of years of human history. Objectively, as a persistent value, perhaps we should assume revenge is "good." Finally, he (surprise) discovers that the system he has chosen supports the values he has adopted for himself. So, who selected this "valuational base," packed with "de facto values and principles"? Why, it was people with whom he agrees! Who would have guessed it?!

Years ago, in a college ethics class, I was chastised by a philosophy professor because of my answer to the question: "What do many of these different ethical systems have in common?" My answer: "They were all designed by people to be guided by principles chosen by people very much like themselves." So frankly, my personal favorite is Mammy Yokum, who stated it better, in far fewer words: "Goodness is better than badness, 'cause it's nicer."

John Clinger
Richmond, Virginia

From Paul Kurtz's article, I learned that people who disagree with Kurtz always put the words *immoral* and *debauchery* in quotes, apparently to indicate that they are in error. They also put *ensoulment* in quotes, because they know there is no such thing. And people who disagree with Kurtz don't believe or determine anything: they recoil in horror, propose ethics of revulsion, and actively wish to abandon both reason and freedom. Really, how childish. Kurtz's entire piece can be paraphrased in a sentence: We shouldn't underestimate the fact-based component of moral decisions, which nonetheless have a value-based component beyond the realm of science. Is Kurtz so removed from a world where intelligent, reflective people support the death penalty or oppose euthanasia that he thinks "getting the facts straight" is a shocking concept?

Most Christians, conservatives, and Republicans would not be startled or "recoil in horror" at the self-evident point that one must get the fact-based components straight when making moral decisions. They would reasonably recoil in horror, though, at Kurtz's unhidden arrogance, childish use of scare quotes, and weak attempt at straw-man persuasion tactics.

Tim Fite
Richmond, Virginia

Paul Kurtz states in his article on ethical judgements, "active euthanasia . . . (as practiced in Oregon and the Netherlands)." What we allow here in Oregon is in no way euthanasia. It is hardly even assisted suicide. After independent doctors certify that a terminal patient will die within six months, the patient may request (if competent) a prescription which his physician writes but does not provide or administer. The patient must independently obtain and take it.

What we allow is nothing like what can happen in the Netherlands.

P.M. deLaubenfels
Corvallis, Oregon

Paul Kurtz responds:

I appreciate the clarification that Leon Kass has made of his position. Many opponents of cloning, especially stem-cell research, do object to it on precisely the grounds that I have suggested. It is good to hear that Dr. Kass does not accept the doctrine of "ensoulment," an extra-scientific concept based on theological faith by those who consider the embryo a person. As head of the Presidential Council on Bioethics, he has played a powerful role and he admits that he does "oppose all human cloning, including the creation of cloned embryos for research." In his book Life, Liberty and the Defense of Dignity: The Challenge for Bioethics *(Encounter Books, 2002), he implies a "spiritual dimension" to his opposition. "Life and soul," he states, "are incredibly mysterious" (p. 296). In any case, I find the opposition to embryonic stem-cell research regrettable, since it overlooks the possible benefits that may ensue.*

John Clinger is mistaken in saying that I oppose "objective relativism." I do not—only subjective relativism. I reiterate that science can have a vital role to play in shaping our values, though these are relative *to our interests. Is the opposition to the slaughter of millions of innocent people simply a question of subjective taste, as he seems to imply? Surely the slaughter of innocent people is amenable to rational criticisms. Similarly, one can provide reasoned arguments against policies based on revenge. I have pointed out in my writings in ethics that there are relevant data to consider in moral dilemmas, such as the common moral decencies, shared needs and values, and an appreciation for human rights and responsibilities. Thus, I submit that there are normative principles that are widely recognized that we can draw upon.*

Apparently Tom Fite believes that a "value-based component" is entirely "beyond the realm of science." "The gentleman doth protest too much, methinks!" If he reads my article carefully, he will recognize that I share with him the need for some *skepticism about moral inquiry based on science. But this is not* total *skepticism, which borders on nihilism.*

The field of medical ethics perhaps best illustrates the development of normative principles in treating terminal patients and allowing them (in consultation with their doctors) to make reflective choices. (In answer to P.M. de Laubenfels, I realize that the form of euthanasia practiced in Oregon in this regard goes beyond that allowed in the Netherlands.) Can a rational case be made for some form of euthanasia for adults, including assisted suicide? "The right of privacy," "informed consent," and the "quality of life" of the patient are relevant principles, but these should not be viewed as either absolute commandments nor subjective tastes, but are amenable to reasoned inquiry.

Science, I've said, has a vital, if limited, *role to play in shaping our moral values. To quote from my article, "We ought to consider our moral principles and values, like other beliefs,* open to examination in the light of evidence and reason and, hence, amenable to modification. *" I have suggested some additional criteria we use in evaluating ethical judgments: are our values reliable?, how do they compare with others we hold?, are they consistent?, and, have they been tested in practice? In any case, I am suggesting that the methods of inquiry we use in other areas of human knowledge should be*

applied, however modestly, to the area of ethics. We especially need some degree of skepticism as a necessary antidote to all forms of moral dogmatism—including our own.

Popper and Evolution

Thanks to Massimo Pigliucci for the good article ("Did Popper Refute Evolution?" September/October 2004). Although Pigliucci tells us nothing substantially new, clear expositions like this are always most welcome.

One can show that the line of argument leading to the neo-Darwinian theory (properly framed) is formally valid and, moreover, sound. In addition, if the premise of challenge to reproductive success (Darwin's "struggle for life") is disjoined from the premise of natural selection, as logically it should be, all possible circularity disappears. Finally, since the neo-Darwinian theory is fundamentally a theory of *adaptation*, it is obviously testable (as Pigliucci points out) in terms of the predicted spread of adaptations (i.e., specific features of individuals within a species) via (inclusive) differential reproductive success (natural selection) under the "struggle for life."

I once had the good fortune to discuss certain matters of evolutionary theory with Sir Karl Popper, face to face. My impression was of a man of such remarkable intellectual integrity that a well-considered change of mind would be simply a matter of course.

Frederick Cichocki
Boca Raton, Florida

It Would Have Been Clearer

In his review of the movie *What the #$*! Do We Know?* (September/October 2004), Eric Scerri correctly notes that the moviemakers err in supposing that, because macroscopic biological systems ultimately consist of quantized elementary particles, the behaviors of the former must simply and directly recapitulate those of the latter. However, he incorrectly identifies their error as an example of reductionism, rather than as one of inaccurate analogy and foolish oversimplification.

His statements that "reductionism works in principle but not in practice" and is an "old-fashioned paradigm that . . . everything is indeed nothing but physics," although perhaps technically true, are pejorative in connotation. He should have explained more clearly that (as best we know now) chemistry and biology can be reduced to physics, but that to do so all the time would be needlessly, often impossibly, tedious. Similarly one does not prove all the theorems of mathematics using only the axioms and postulates, but as much as possible, one uses other, previously established, results.

John G. Fletcher
Livermore, California

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THE COMMITTEE FOR THE SCIENTIFIC INVESTIGATION OF CLAIMS OF THE PARANORMAL

Abell 2125: Chandra Catches Early Phase of Cosmic Assembly

Chandra's image of the galaxy cluster Abell 2125 reveals a complex of several massive multimillion-degree-Celsius gas clouds in the process of merging. Ten of the point-like sources are associated with galaxies in the cluster, and the rest are probably distant background galaxies. The small bright feature in the extreme lower right-hand corner is probably a background galaxy cluster not associated with Abell 2125.

Credit: NASA/CXC/UMass/Q.D.Wang et al.

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